

CHANGES IN THE HYPOTHALAMIC NUCLEI IN IN EXPERIMENTAL ALLERGY

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Previously it has been shown that extracts of the posterior and anterior hypophyseal lobes exert a desensitizing action. By use of such extracts injected into rabbits at the height of protein sensitization it has been possible to eliminate or greatly to reduce the phenomenon of Arthus [1, 4]. It has also been shown that in the development of the Arthus phenomenon oxytocin and sometimes vasopressin is present in the cerebrospinal fluid taken at the height of the anaphylactic reaction. The increased liberation of hypophyseal hormones in allergy is associated with a marked lability of the blood pressure. In many cases after repeated sensitization of animals and development of the Arthus phenomenon a marked hypertension has been observed [5, 6].

Taking into account results on the relationship of the reduction of hypophyseal hormones to the activity of the hypothalamus, and remembering also the secretory activity of the hypothalamic nuclei [7, 8], we have set out to investigate the reaction of the hypothalamic nuclei and posterior hypophyseal lobe at the height of the manifestation of the Arthus phenomenon.

EXPERIMENTAL METHOD

The experiments were carried out on seven rabbits in which the carotid arteries were brought to the outside on a fragment of skin, and in which the Arthus phenomenon had been induced in a joint. The method of sensitization was first, every 5 or 6 days, to inject into rabbits subcutaneously fresh horse serum. After the 4th or 5th injection, the same amount of serum was injected into a joint. Two rabbits were investigated at the height of the manifestation of the Arthus phenomenon. The remaining five animals were again sensitized after 5-6 months, and the Arthus phenomenon again evoked.

EXPERIMENTAL RESULTS

In animals in which sensitization had been repeated the blood pressure was increased to 30-35% above normal values. The results led us to suppose that the increased liberation of vasopressin is brought about not only by the hypophysis but also by the neurones of the anterior hypothalamus.

For histological study of the neurones of the supraoptic and paraventricular hypothalamic nuclei the brains were fixed in Bouin's fluid and then embedded in celloidin-paraffin; serial sections were then cut. Every fifth section was stained by Gomori, and a study of the hypothalamic nuclei was made for neurosecretion. In the intact rabbits the cells of the supraoptic nucleus contain a granulation having a positive Gomori reaction diffusely distributed throughout the whole cytoplasm. In the superficial layer of the protoplasm these granules extend into the zone where clumps of Nissl substance are concentrated. In the cells the nuclei are rounded and have small clumps of chromatin distributed about the surface of the nucleus and clearly defined nucleoli. Numerous capillaries were visible between the cells (Fig. 1).

In rabbits at the height of sensitization, after manifestation of the Arthus phenomenon, a large number of small or large solitary vacuoles developed in the neurones of the supraoptic nucleus. There was a great reduction in the number of granules giving a positive Gomori reaction. Indentations then appeared in the nuclei so that they lost their regular form. This result indicated a loss of neurosecretion, and it was accompanied by a swelling of the cells and a considerable increase in their size in comparison with those of the intact animals (Fig. 2). The mean value of the cross sectional area of the cells of the supraoptic nucleus increased to $318.1 \mu^2$ compared with the value of $140.3 \mu^2$ in the control animals.

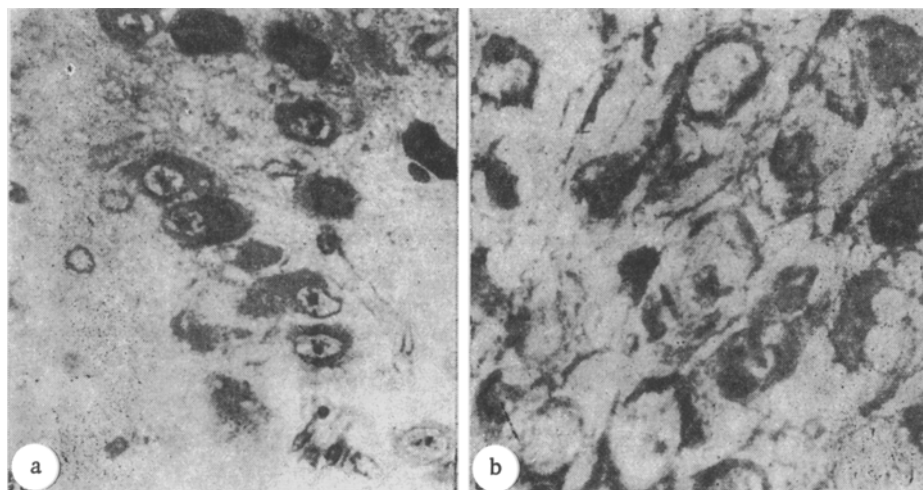


Fig. 1. Changes in the hypothalamic nuclei in allergy. a) Supraoptic nucleus of intact rabbit; b) supraoptic nucleus of allergic rabbit. Fixation in Bouin; stained by Gomori. Magnification 324X.

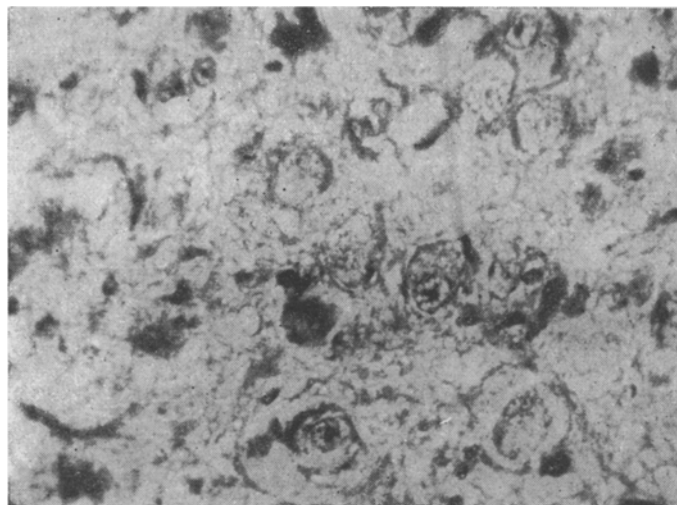


Fig. 2. Paraventricular nucleus of allergic rabbit. Fixed in Bouin; stained in Gomori. Magnification 324X.

The neurones of the paraventricular hypothalamic nucleus of an intact rabbit were filled with small grains evenly distributed throughout the cytoplasm and giving a positive Gomori reaction; the nuclei were round with a definite structure. The mean cross sectional area of these cells was $177.3 \mu^2$.

In the experimental animals, after prolonged sensitization and the elicitation of the Arthus phenomenon, the cells of the paraventricular nucleus lost their Gomori-positive granules and there was less vacuolization of the cytoplasm than in the supraoptic neurones (Fig. 3). The mean value of their cross section was $243 \mu^2$.

In the posterior hypophyseal lobe of the allergic rabbits there was a loss of the Herring bodies, whereas in the intact animals many of these bodies were retained.

Thus at the height of the manifestation of the Arthus phenomenon, particularly after prolonged sensitization, signs appeared of enhanced neurosecretion, which was shown by an increase of secretory area and by changes of cell structure. Further study will show to what extent these changes are specific to the allergic reactions. However, a

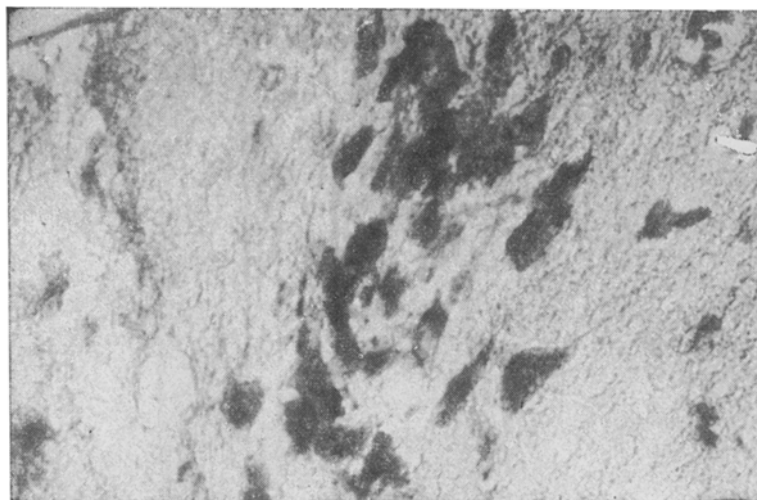


Fig. 3. Supraoptic nucleus of rabbit with moderately severe inflammation induced by turpentine. Fixation in Bouin; stained in Gomori. Magnification 324x.

comparison of the results reported with those obtained under normal circumstances in moderately severe inflammation (Fig. 3) indicates that in experimental allergy a marked activation of hypothalamic neurosecretion occurs, and it is much better shown in the cells of the supraoptic than of the paraventricular nucleus. If we take that into account in animals which have been kept sensitized for a long time, we must interpret the considerable swelling of the neurosecretory cells and their loss of accumulated neurosecretion as an indication of the increased liberation by the cells of vasopressor substances and of oxytocin, an excess of which can be found in the fluid secreted.

SUMMARY

In rabbits subjected to prolonged sensitization and in which the Arthus phenomenon was induced there was a marked reaction of the hypothalamic nuclei. Staining by Gomori's method indicated a cellular swelling, loss of granules, and protoplasmic vacuolization in the supraoptic nucleus. There was a considerable increase in the size of the cross-sectional area of the cells. The same effects were much less well shown in the paraventricular nucleus. These results show that marked signs of increased neurosecretion developed in the animals at the height of the Arthus phenomenon.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. Some or all of this periodical literature may well be available in English translation. A complete list of the cover-to-cover English translations appears at the back of this issue.
