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FUNCTIONAL STATE OF NEUROSECRETORY CELLS IN THE SUPRAOPTIC NUCLEUS OF THE HYPOTHALAMIC-PITUITARY-NEUROSECRETORY SYSTEM IN INTACT RATS.

Abstract: This study focuses on evaluating the morpho functional characteristics of neurosecretory cells (NSCs) in the supraoptic nucleus (SON) of the hypothalamic-pituitary-neurosecretory system (HPNS) in intact rats. Different types of NSCs (with high, medium, and low functional activity) and their quantitative ratios were determined. The structure of the SON, the size of the nucleus and cytoplasm of NSCs, the number of neurosecretory substances, and the interaction with glial cells were studied. The obtained data describe the physiological state of the HPNS and serve as a basis for understanding changes occurring under the influence of various pathological factors.

Keywords: Hypothalamic-pituitary-neurosecretory system, supraoptic nucleus, neurosecretory cells, functional activity, morphology, rat.

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ФУНКЦИОНАЛЬНОЕ СОСТОЯНИЕ НЕЙРОСЕКРЕТОРНЫХ КЛЕТОК СУПРАОПТИЧЕСКОГО ЯДРА ГИПОТАЛАМО-ГИПОФИЗАРНО-НЕЙРОСЕКРЕТОРНОЙ СИСТЕМЫ У ИНТАКТНЫХ КРЫС.

Аннотация: Данное исследование посвящено оценке морфофункциональных характеристик нейросекреторных клеток (НСК) супраоптического ядра (СОЯ) гипоталамо-гипофизарно-нейросекреторной системы (ГГНС) у интактных крыс. Были определены различные типы НСК (с высокой, средней и низкой функциональной активностью) и их количественное соотношение. Изучены структура СОЯ, размеры ядра и цитоплазмы НСК, количество нейросекреторных веществ и взаимодействие с глиальными клетками. Полученные данные описывают физиологическое состояние ГГНС и служат основой для понимания изменений, происходящих под воздействием различных патологических факторов.

Ключевые слова: Гипоталамо-гипофизарно-нейросекреторная система, супраоптическое ядро, нейросекреторные клетки, функциональная активность, морфология, крыса.

Introduction: The hypothalamic-pituitary-neurosecretory system (HPNS) plays a crucial role in the neurogenic and humoral regulation of the body. One of the key structures of the HPNS is the supraoptic nucleus (SON), which contains neurosecretory cells (NSCs) that produce vasopressin and oxytocin. These neurohormones are involved in maintaining homeostasis, responding to stress, and regulating other essential physiological processes. Under the influence of various extreme and non-extreme factors, the reactivity of the HPNS may change, affecting adaptive processes. Therefore, studying the functional state of NSCs in the SON in intact conditions is of significant importance.

Materials and Methods:

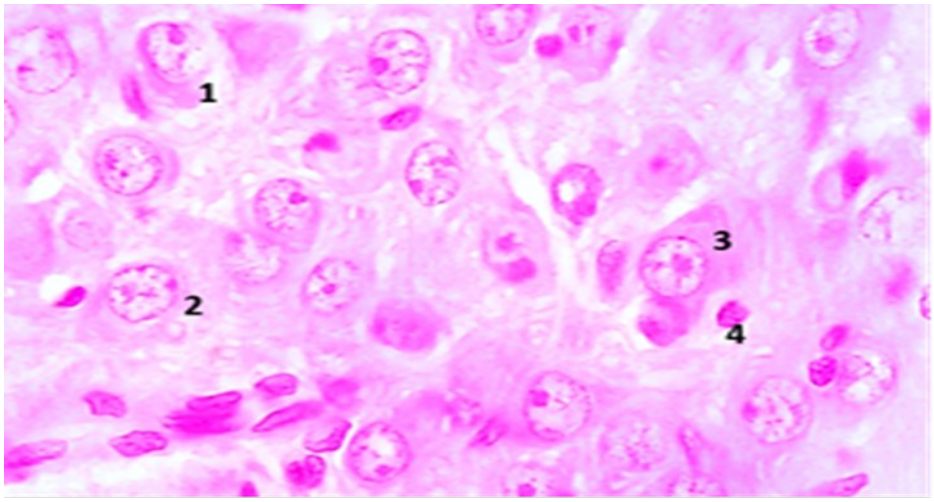
- **Research Subjects:** Intact (healthy) rats.
- **Groups:** Intact group (control group).
- **Histological Methods:** Preparation and staining of SON samples.
- **Microscopy:** Examination of the morphological characteristics of NSCs (shape, nuclear size, cytoplasmic volume, quantity of neurosecretory granules).
- **Immunohistochemical Methods:** Detection of neurosecretory substances using the periodic acid-Schiff (PAS) reaction.
- **Morphometry:** Measurement of nuclear and cytoplasmic volumes.
- **Statistical Analysis:** Data processing to identify differences between groups.

Results: In the intact group, NSCs in the SON predominantly exhibited moderate functional activity. NSCs with high functional activity were characterized by neurosecretory substances concentrated around the nucleus and in the expanded regions of axons. These cells had larger nuclei with eccentric nucleoli, sometimes containing two nucleoli.

Neurosecretory cells were evenly distributed in the SON, with the majority being round, while some had angular shapes. Based on their activity, NSCs were categorized into four types:

1. **Type I (High activity):** 12.6±0.51% of NSCs. PAS-positive granules were sparsely distributed around the nucleus. The nuclei were large with eccentric nucleoli.
2. **Type II (Moderate activity):** 66.0±1.2% of NSCs. PAS-positive granules were moderately dense, concentrated around the nucleus and initial axonal segments. The nuclei were elliptical with dispersed chromatin and centrally located nucleoli.
3. **Type III (Low activity):** 18.0±1.6% of NSCs. PAS-positive granules were densely packed in the cytoplasm and along the axons. The nuclei displayed dense chromatin with centrally positioned nucleoli.
4. **Type IV (Pyknotic, hyperchromatic, destructive cells):** 3.4±0.3% of NSCs.

The average nuclear volume of NSCs was 399.5±6.8 μm³, while the average cytoplasmic volume was 1819.0±25.2 μm³. The nucleus-to-cytoplasm ratio was 0.228±0.004. The average content of neurosecretory substances was 201.9±1.7 arbitrary units. Glial cells were interspersed among NSCs, with an average of 4.9±0.1 NSCs and 2.84±0.1 glial cells per 25,000 μm², resulting in an NSC/GLC index of 1.73±0.03. The glial nuclei were ellipsoid, with diffusely distributed chromatin. Blood vessels in the SON displayed moderate filling, with capillaries of an average diameter of 5.56±0.1 μm.



Discussion: The findings describe the functional state of NSCs in the SON of intact rats, with a predominance of moderately active NSCs indicating basal neurosecretory activity. The presence of different NSC types reflects the dynamic and adaptive properties of the SON. The interaction between glial cells and NSCs likely plays a regulatory role in neuroendocrine function.

Conclusion: This study provides valuable insights into the morphofunctional characteristics of NSCs in the SON of intact rats. The results enhance our understanding of the physiological state of the HPNS and serve as a foundation for future research on pathological changes in this system.

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