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Commentary

The Hypothalamus: A Critical Regulator

Nagavendra Sinopi*

Department of Medicine, Christian Institute of Nursing Sciences and Research, Nagaland, India

COMMENTARY

The hypothalamus is one of the brain's oldest and tiniest structures, accounting for only 4 gm of the 1400 gm of mature human brain weight. Despite this, the brain circuitry that controls basic life functions is remarkably conserved in this limited area. Some of the function that is carried by hypothalamus are fluid and electrolyte balance, from drinking to fluid absorption and excretion; metabolism, from eating to digestion, metabolic regulation, and energy expenditure, wake-sleep cycles and emergency reactions to environmental stressors; thermoregulation, from environment selection through heat production and conservation, and fever responses; wake-sleep cycles and emergency responses to environmental stressors and even the regulation of reproduction which includes controlling the reproductive hormone. From the most anterior end of the growing neural tube, the hypothalamus emerges. The majority of it is generated from the diencephalon's ventral half, but its most rostral component, the preoptic area, is derived from the telencephalon. However, it is impossible to separate these components in the adult brain. The ventral surface of the hypothalamus is the easiest to identify. It is bordered on the front by the optic chiasm, on the side by the optic tracts, and on the back by the mammary body. It is encircled by the Willis Circle's blood vessels. On each side of the brain, the hypothalamus is symmetrically duplicated, with the third ventricle in the middle forming a border between the two sides [1]. The hypothalamus is a structure in vertebrates that is formed of many nuclei of interrelated cell populations and is located ventrally to the thalamus and dorsally to the anterior pituitary. Several neuronal types are found in each nucleus, and they act in concert within and across nuclei to govern physiological functions including as metabolism, water balance, satiety, reproductive physiology, circadian rhythm, and emotional responses [2]. As it has been seen that hypothalamus play major role in regulating many of the function which are concern with hormone regulation. It also play role in functioning of thyroid. The pituitary gland's ability to maintain thyroid size and increase thyroidal iodine accumulation has been found to be incompatible. The hypophysis is unable to induce thyroid cell growth when the pituitary is not in direct contact with the hypothalamus, or when some parts of the anterior hypothalamus are damaged by electrolytic lesions, but it is still able to maintain an almost normal thyroidal iodine metabolism. This suggests that the pituitary may secrete two thyrotropic substances, dubbed "growth factor" and "metabolic factor" arbitrarily. The release of the growth factor appears to be dependent on the hypothalamus's immediate proximity. The hypothalamus has no substantial influence on the metabolic factor. Both factors appear to be influenced, at least in part, by the amount of thyroid hormone in circulation. The mechanism by which the hypothalamus exerts control over the growth factor is unknown. This control could be neurological or neurohumoral, with the latter proving to be the more plausible option [3]. The hypothalamus is a control centre for the autonomic nerve and endocrine systems, with two types of pathways connecting it to the pituitary gland's numerous lobes. The first is a vascular connection to the anterior pituitary, which provides hormones that drive anterior pituitary hormone release. The hypothalamus extends into the posterior pituitary. As a result, nerve fibres connect it to it. The hypothalamus secretes hormone-releasing hormones that either stimulate or inhibit the release of various anterior pituitary hormones, acting as the hub of a negative feedback network. The neurological system controls thyroid, adrenal, and gonadal function, as well as growth and somatic development, due to the intimate contact between the hypothalamus and the pituitary gland [4]. The hypothalamus is responsible for appetite regulation. The Lateral Hypothalamic Area (LHA) was thought to be the 'hunger centre,' while the ventromedial hypothalamic nucleus was thought to be the 'satiety centre,' based on early hypothalamic lesioning research. Many more hypothalamic nuclei and neural circuits, connecting with the brainstem and higher cortical centres, have now been discovered to be involved in appetite regulation [5]. There are many other function and effect related with hypothalamus in the body. The hypothalamus and medulla are most affected by the functional cerebral alterations found in hypertensive animals' brains. The justification for limiting a review to certain changes that take place in the hypothalamus (and certain areas immediately anterior) stems from the conclusion that hypertension appears to be due to an increase in medullary pressor activity due to a suppression from above of medullary inhibitory activity [6-7]. The medullary control of arterial pressure in the central nervous system comes from a tonic excitatory centre in a rostro-ventral nucleus with spinal excitatory fibres to the spinal intermediolateral nucleus, which controls sympathetic ganglia and the adrenal medulla.

Correspondence to: Nagavendra Sinopi, Department of Medicine, Christian Institute of Nursing Sciences & Research, Nagaland, India, E-mail: nagvesino9067@gmail.com

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The medulla's excitatory centre is under the influence of the hypothalamus, the midbrain, a medullary inhibitory centre slightly more caudal than the excitatory centre, and the nucleus tractus solitaries [6,8]. The activity of the hypothalamus-pituitary-adrenal axis is thought to play a role in the pathogenesis of the metabolic syndrome. The metabolic syndrome is established in diet-induced obesity mouse models by eating a high fat diet. However, when it comes to hypothalamus-pituitary-adrenal-axis activity, the models produce mixed outcomes [9]. The sexual dimorphism of migraine is one of the key justifications for looking for an explanation in hypothalamic networks. Migraine is a 'female condition,' with three times the occurrence of men after puberty, and this gender disparity is most likely due to the transition to puberty. In fact, migraine manifests for the first time at menarche in one-third of affected women, and the relative risk of having a migraine attack on days -2 to +3 of menstruation has been estimated to be about twice the risk of having an attack at other times of the months. Given the hypothalamus' essential role in maintaining homeostasis, symptoms could indicate hypothalamic dysfunction prior to a migraine onset [10].

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