Anatomical and Histological Characteristics of Pituitary Gland in Domestic Animals

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Abstract

As it regulates important physical functions and general wellbeing, the hypophysis plays a major role in responding to the increased demand for different hormones. In the current review, we described the anatomical and the histological structures of the pituitary glands in different domestic animals. Unlike other glands, the pituitary gland has two main parts; the adenohypophysis (anterior lobe), which contains multiple populations of endocrine cells and is responsible for producing each of the pituitary trophic hormones. Another part of the pituitary gland is that the neurohypophysis (posterior lobe) secretes granules that contain certain neurohypophyseal hormones, like antidiuretic hormone and oxytocin, which are synthesized in the hypothalamus.

Keywords: domestic animals, effectiveness, hormones, hypophysis, structure.

Introduction

As a key component of regulating physical functions and general welfare, the hypophysis plays a significant role. Although the animal's body is complex and has many functions, it is significantly effective, and it is controlled by two main systems: the nervous system and the endocrine system. A nerve's chemical and electrical signals are carried at high speed by the nervous system, resulting in a high rate of organ activity. The endocrine system synthesizes and releases chemicals substances in the body of animals. This system has many functions and presents slowly but persists for a long time. During development, the pituitary gland has two lobes, the anterior lobe (adenohypophysis) and the posterior lobe (neurohypophysis . Adenohypophysis develops from the (Rathke's pouch) of oral ectoderm, whereas the neurohypophysis develops from neural ectoderm and diencephalons. The pituitary gland or hypophysis can be considered the master organ in domestic animals, which produced many hormones that directly activated other endocrine organs. The signals that send to different glands and organs in the body are regulated by the pituitary gland which maintained their function. The messengers are transmitted through many hormones secreted from this gland and passed the information from the hypophysis to distant cells, regulating their activity. As with other glands, their actions are similar, as are those of the adrenal cortex. Other body functions and regulations also might be influenced by the action of this gland.

Anatomical characteristics

Because it is an appendage of the brain, it has significance as a relay between nervosa and hormonal mechanisms that control certain functions in conjunction. Located at the ventral midline of the diencephalon, the hypophysis cerebri is suspended from the hypothalamus by a cylindrical stalk. It is an extension of the median eminence of the hypothalamus, referred to as the pars proximalic neurohypophysis. A gland's oval shape resembles a peanut (peanut-like), a disc in shape in rats, and it is bilaterally symmetrical from a sagittal plane in size and shape. The terminal of the hypophysis in Bactrian camels is a tiny protuberance that served as the neurohypophysis terminal. There are two endocrine glands in the brain, one of these is the Pituitary gland which is gray-red in color and positioned down dorsolaterally, and have an oval shape structure in donkeys. Anatomical structures of the gland are very affected by the seasons, age, and sex of the animals (Dent 1961). The pituitary gland in rats is unpaired. It is a disc in shape and positioned in the caudal part of the brain. It is surrounded by a very thin white capsule which is part of the dura mater called the (sella diaphragm) in rats. While in the dogs and small ruminants, the gland is rounded in shape, placed in the sella, next to the optic chiasm there is a small slip in the sphenoid bone that is positioned on the base of the brain

Histological characteristics

In the pituitary gland, there are two parts: the anterior pituitary, also known as the adenohypophysis, and the posterior pituitary, also known as the neurohypophysis. The adenohypophysis, is composed of three pars distalis, pars tuberalis and pars intermedia.

The hypophysisis enclosed by a thinner coat of capsule with connective tissue, mainly collagen fibers and reticular fibers. In addition to the outer adenohypophysis, the inner neural part of the gland (neurohypophysis) exhibits numerous histolocytological features. The adenohypophysis and the neurohypophysis are connected together by thick layers of connective tissue. The adenohypophysis is divided into three zones, pars distalis, pars tuberalis, and pars intermediate. The parenchyma of the pars distalis components are organized as clusters or cords, which are covered by accurate connective tissue stroma that contained cells composed of large sinusoidal capillaries. The pars distalis is based solely on the staining properties of secretory granules within the cells. Secretory granules have an affinity for acidic and basic dyes, allowing histologiststo distinguish basophils, acidophilus, and chromophobes based on their staining reaction. Seven types of cells in pars distalis could be recognized by immunohistochemical techniques and electron micrographs (Ye et al 2018; Moriarty 1974). The pars tuberalis forms a sleeve around the stalk of infundibulum. Its thickness is 25-60 µm. It consists of highly vascularized cord, of epithelial cells. In humans, pars tuberalis is not known with certainty, the pars tuberalis encircled the infundibulum of the neurohypophysis. There are four cell types in buffaloes: 1- Light cells: Large pale polygonal cells, 2- Magenta- syncytial cells: The syncytium loaded with ovoid or irregularly triangular nuclei with dark chromatin, 3-Double squamous cells: This type of cells lied at the periphery of the pars tuberalis and encircled the pars nervosa, it consisted of two layers of small squamous cells with fine magenta secretion granules similar to that of the magenta-syncytial cells, 4-Water- clear cells: There are two types of cells, small and large, spherical. It is smaller than the light cells, found in a small number. It has a pale water- clear empty cytoplasm with dark spherical to ovoid nuclei.

Rats, pigs, and camels have well-developed pars intermedia (Malallahand Hussin 2010; Hewitt 1950). It lies close to the neurohypophysis and is separated from the pars distalis by a cleft. As a result of dense connective tissue intermingling with cells, the pars intermedia are poor. Many cells migrate from the pars intermedia into the pars nervosa. Two types of cells can be found in the pars intermedia; magenta cells have dark granules, while chromophobe cells are devoid of granules in their cytoplasm (Mahmood 2014). The pars nervosa, the infundibular stalk, and perhaps the median eminence are involved in neurohypophysis. The connective tissue, pituicytes, large numbers of nerve fibers without myelin, and capillaries are the main structures of this part.

Conclusions

In conclusion, the unique structure of the pituitary gland -which consists of two main parts; the adenohypophysis (anterior lobe) contains multiple populations of endocrine cells- is responsible for synthesizing and secreting each of the pituitary trophic hormones. The other part is the neurohypophysis (posterior lobe) is responsible for the secretion of granules that contain the neurohypophyseal hormones, i.e., antidiuretic hormone (ADH, vasopressin) and oxytocin, which are synthesized in the hypothalamus.

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