Neuroanatomy and Physiology of the Avian Hypothalamic/Pituitary Axis: Clinical Aspects

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KEYWORDS

• Hypothalamus • Pituitary • Birds • Endocrine • Adenohypophysis
• Neurohypophysis

KEY POINTS

- The pituitary gland (hypophysis) is a small gland that is intimately connected to the hypothalamus at the base of the brain and is classified as either adenohypophysis or neurohypophysis.
- The avian thyroid glands are paired glands located ventrolaterally to the trachea. The histology of the avian thyroids is the same as in mammals: organized into follicles filled with colloid and lined with cuboidal epithelial cells that secrete into the interior of the follicles.
- Adrenal lesions in birds have been described postmortem only. Antemortem diagnosis of adrenal disease has not been reported in birds. It is believed, however, that the ACTH stimulation and low dose dexamethasone suppression test can potentially be used in birds for the diagnosis of hypoadrenocorticism and hyperadrenocorticism.
- In birds, as in other verterbrates, gonadotropin-releasing hormone (GnRH), also known as luteinizing hormone releasing hormone (LHRH), released from the hypothalamus, is the primary factor responsible for the release of gonadotropins (luteinizing hormone [LH], follicle-stimulating hormone [FSH], and prolactin) by the anterior pituitary gland. Gonadotropins bind to their gonadal receptors and affect the function of the ovaries and testes.
- The 2 hormones of the neurohypophysis, arginine vasotocin (AVT) and mesotocin (MT), are produced by and secreted from separate neurosecretory neurons. AVT and MT are transported bound to carrier proteins by axoplasmic transport. The hormones are then stored in pars nervosa before release.

INTRODUCTION

Avian endocrinology is an area that is frequently unfamiliar to practitioners; however, it is important to have a thorough understanding of normal endocrinology because abnormalities may be more frequently diagnosed. It is of critical importance to always confirm a clinical presentation of an endocrine disorder before treatment. It may be difficult to confirm a diagnosis once treatment has been instituted, and improper or inadequate treatment can be fatal.

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ANATOMY OF THE AVIAN HYPOTHALAMIC/PITUITARY AXIS

The pituitary gland (hypophysis) is a small gland that is intimately connected to the hypothalamus at the base of the brain and is classified as either adenohypophysis or neurohypophysis. Embryonically, the adenohypophysis is derived from the Rathke pouch and the neurohypophysis is derived from the infundibulum. In mammals, the adenohypophysis is composed of the pars distalis (anterior pituitary gland), the pars intermedia, and the pars tuberalis. Unlike in mammals, however, birds do not have a pars intermedia, and therefore the adenophypohysis forms the pars distalis. The neurohypophysis forms the pars nervosa (the posterior pituitary gland), the infundibular stalk, and the median eminence (**Fig. 1**).[1]

Adenohypophysis

The pars distalis (anterior pituitary gland) is separated into a cephalic lobe and a caudal lobe and it makes up most of the adenohypophysis. It is ventrally situated to the neurohypophysis. It develops 6 distinct hormones: the gonadotropins (lutenizing hormone [LH] and follicle-stimulating hormone [FSH]), thyrotropin (TSH), prolactin, growth hormone (GH), and adrenocorticotropic hormone (ACTH). The anterior lobe of the pituitary gland is supplied by a series of blood vessels, including the hypophyseal portal vessels, which provides a route from the neurosecretory nerve terminals in the median eminence to the anterior pituitary gland.[1]

Neurohypophysis

The pars nervosa (posterior pituitary gland) consists of the neurosecretory terminals, which release either mesotocin (MT) or arginine vasotocin (AVT). These hormones are synthesized in cell bodies in the nuclei in the hypothalamus and are transported to the posterior pituitary gland through modified axons.[1]

HYPOTHALAMUS-PITUITARY-THYROID AXIS

The avian thyroid glands are paired glands located ventrolaterally to the trachea. The histology of the avian thyroids is the same as in mammals: organized into follicles filled

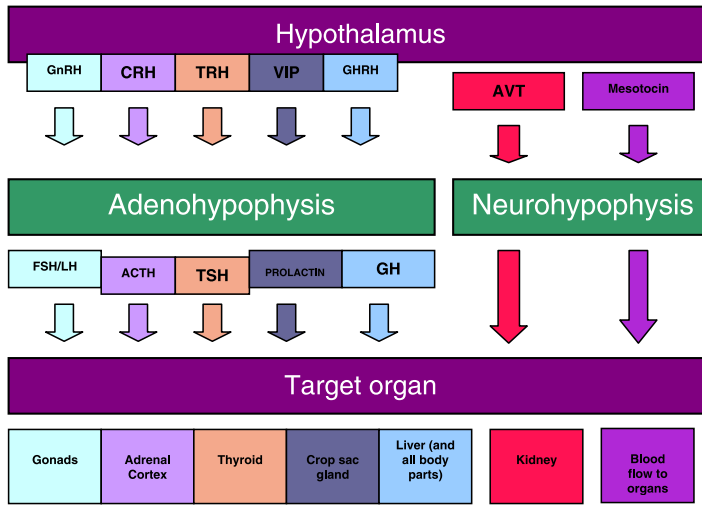

Fig. 1. Avian hypothalamic/pituitary axis pathways.