Practical 9: Histology of the Hypothalamic-Pituitary gland axis

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Aim:

To introduce students to neuro-endocrine relations by studying the histology of the hypothalamic–pituitary (HP) axis and some aspects of histopathology of the pituitary gland.

Specific Objectives:

1. To know the structure of the pituitary gland.
2. To understand the terms hypophysis; adenohypophysis; neurohypophysis; hypothalamohypophysial portal system.
3. To describe the parts of the adenohypophysis and to identify chromophilic cells (acidophils, basophils) and chromophobic cells of the pars distalis.
4. To know the structure of the neurohypophysis and the process of neurosecretion.
5. To know the histology of the adrenal gland.
6. To recognize some features of basic histopathology of the hypophysis.

Learning Activities:

Pituitary gland (Human, Tri-PAS and Ox, Picro-Mallory)

At low magnification, identify the paler **neurohypophysis** consisting of pars nervosa (posterior lobe) and infundibulum (neural stalk). The nuclei scattered throughout the pars nervosa belong to cells called **pituicytes**, which are a type of neuroglial cell. Capillaries lined by elongated endothelial cells are present in the neurohypophysis.

The **adenohypophysis** is made up of pars distalis (anterior lobe), pars intermedia (intermediate lobe), and pars tuberalis (tuberal lobe that grows around the infundibulum). Note regional differences in staining of pars distalis that reflect regional differences in proportions of acidophils (intense magenta colour due to non-glycosylated proteins in cytoplasm), basophils (dark blue/purple cytoplasm due to the glycosylated proteins in cytoplasm) and chromophobes (do not take up dyes well).
Note the colloid-containing follicles (Rathke's cysts) in the pars intermedia; some follicles are lined by simple cuboidal/columnar epithelium derived from oral ectoderm. Basophils are more obvious in the pars intermedia (they sometimes grow in strands into the pars nervosa). Numerous sinusoidal capillaries are found in the adenohypophysis.

Hormones of human hypophysis

Chromophobes (50%)	(ACTH); stem cells
Acidophils (40%)	GH; LTH (prolactin)
Basophils (10%)	FSH; LH; MSH; TSH; ACTH

In the **pars tuberalis**, note the high density of venules packed with blood; these vessels belong to the hypothalamohypophysial portal system. Some thin arterioles with a pleated internal elastic lamina are also seen in this region.

The organ is surrounded by dense irregular connective tissue related to the dura mater. Connective tissue (reticular and collagen fibres) permeates the adenohypophysis and is very dense in the pars intermedia.

Pituitary gland

This slide is stained with H&E and shows similar features to the previous slides. The pink acidophils stand out but the difference between basophils and chromophobes. Herring bodies are seen occasionally in the more distal region of the pars nervosa. Some pituicytes in the pars nervosa aggregate in dense clusters.

Adrenal gland, primate – H&E

Identify the collagenous capsule and the cortical and medullary regions.

Within the cortex are 3 zones; namely Zona Glomerulosa (where the cells are arranged into ovoid groups and produce mineralocorticoids e.g. aldosterone increases sodium resorption from the glomerular filtrate by the kidney's distal convoluted tubules), Zona Fasciculata (where cells are arranged into columns) and Zona Reticularis (bordering the medulla and cells forming cords). Both Zona Fasciculata and Zona Reticularis produce glucocorticoids of which cortisol is the most important by suppressing the immune system through arresting mitotic activities in the lymphoid tissues and decreasing the production of antibodies. These hormones are regulated by ACTH produced by the anterior pituitary gland.

As the adrenal gland is an endocrine structure, both the cortex and medulla have many capillaries (sinusoids) running between the cells. In the medulla many sinusoids drain into medullary veins. The cells in the medulla are the chromaffin cells with their granular appearance indicative of adrenalin and noradrenalin. The release of these hormones is under direct control of the ANS.

HISTOPATHOLOGY

Pituitary gland Histopathology (UNSW Powerpoint - courtesy Prof. Kumar)

Compare the causes of excessive pituitary function (hyperpituitarism) versus diminished hormone secretion (hypopituitarism). Hormone-secreting tumours that are homogeneous in microscopic appearance (clonal origin) are associated frequently with hyperpituitarism. So-called non-functional tumours of the hypophysis that do not secrete hormones may still lead to hormonal imbalance due to compression and damage to adjacent normal tissue. Expansion of a tumour into the sella turcica may cause visual defects due to compression of the nearby optic chiasm. Vascular accidents (infarcts) are often associated with hypopituitarism.

Pituitary gland Adenoma (human)

This is a small segment of an enlarged mass of acidophils in the adenohypophysis. Although the huge size of the adenoma is apparent, the histological processing has resulted in many shrinkage spaces and distortion.

Pituitary gland Adenoma (dog)

This adenoma is better preserved and its acidophilic nature is easier to identify.

Pituitary with partial infarct

This a horizontal section through the hypophysis. The neurohypophysis appears normal and shows some distinct Herring bodies. Parts of the adenohypophysis appear normal and exhibit regional differences in the concentrations of chromophobes and chromophils; the infarct appears to be confined to one side.

Images of the HP axis

Site from Colorado State University describing the anatomy, histology and pathophysiology of the HP axis, with images:
http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/index.html