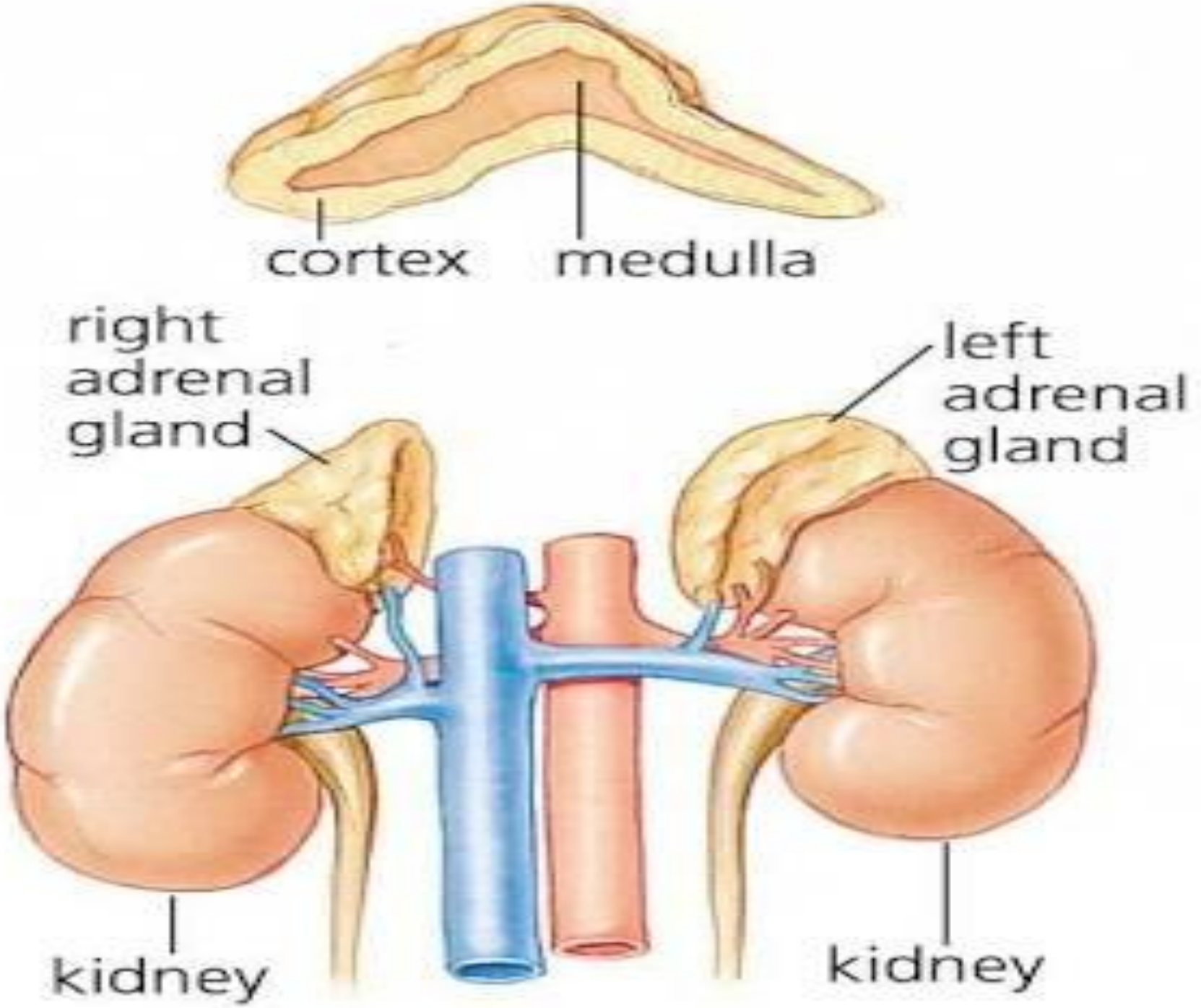
# ADRENAL GLANDS

- **The adrenal (or suprarenal) glands are paired endocrine glands situated over the medial aspect of the upper poles of each kidney.**
- **They secrete steroid and catecholamine**

**hormones directly into the blood.**


cortex
medulla
right adrenal gland
left adrenal gland
kidney
kidney

- **Diameter-** **vertical- 50mm**

  **transverse-30mm**

  **AP - 10mm**

**Weight- 5 gm**

**Right suprarenal gland- tetrahedral in shape, it has 3 borders ( anterior, medial, lateral), 3 surfaces (anterior, posterior), apex and base.**

**Left suprarenal gland- semilunar in shape**

**It has 2 borders (lateral and medial), 2 surfaces (anterior and posterior), 2 poles( upper and lower)**

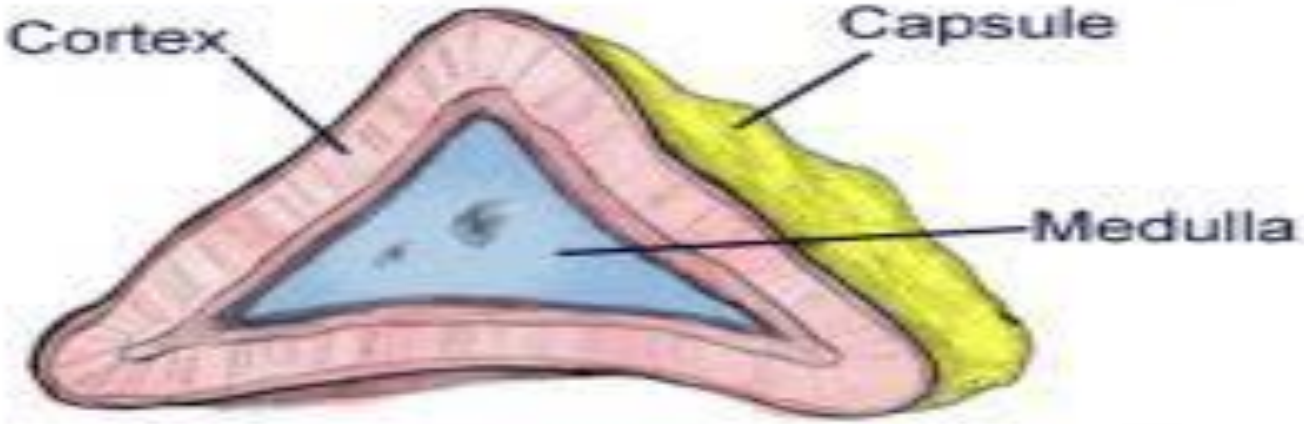
- **Structure-**

**The suprarenal gland is surrounded by a capsule. Septa arising from the capsule extend into the substance of the gland.**

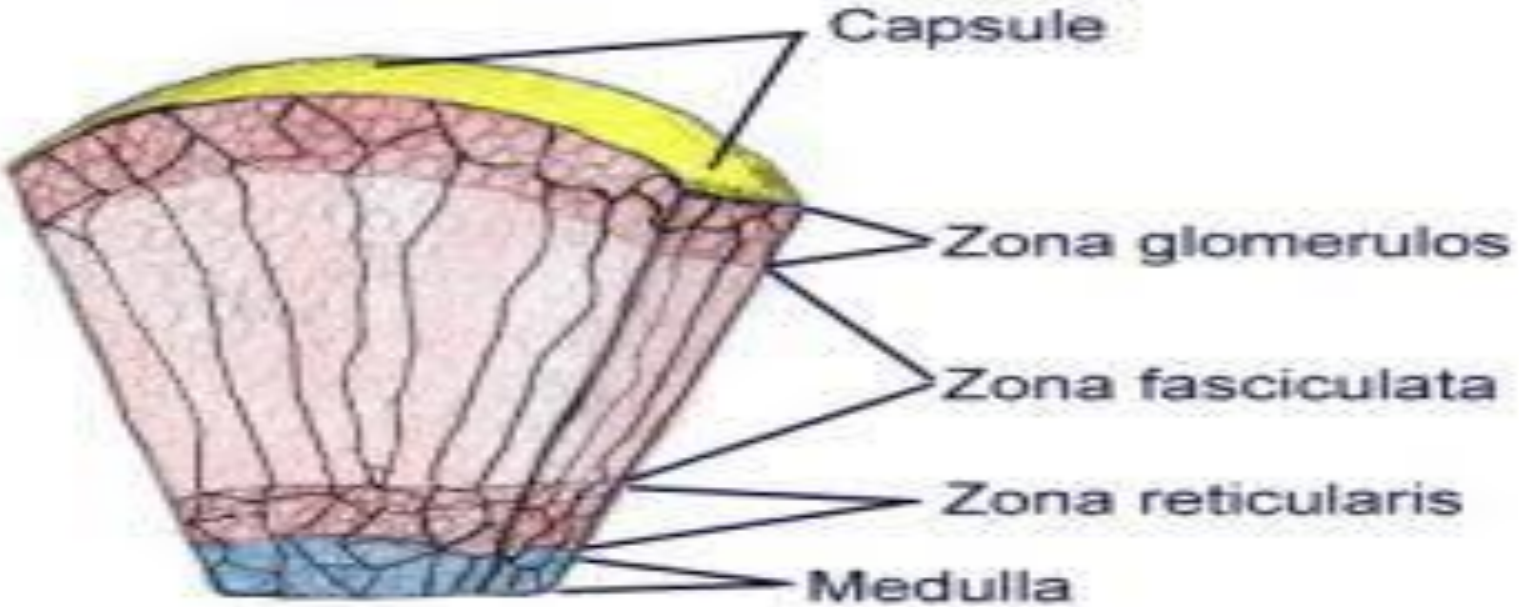
**The gland is made up of a superficial part called the cortex and a deeper part called the medulla.**

**Cortex can be divided into 3 zones-**

1. **The outermost zone - zona glomerulosa- mineralocorticoids**
2. **The middle zone- zona fasciculata- glucocorticoids**
3. **The inner zone- zona reticularis- sex hormones**




Transverse section

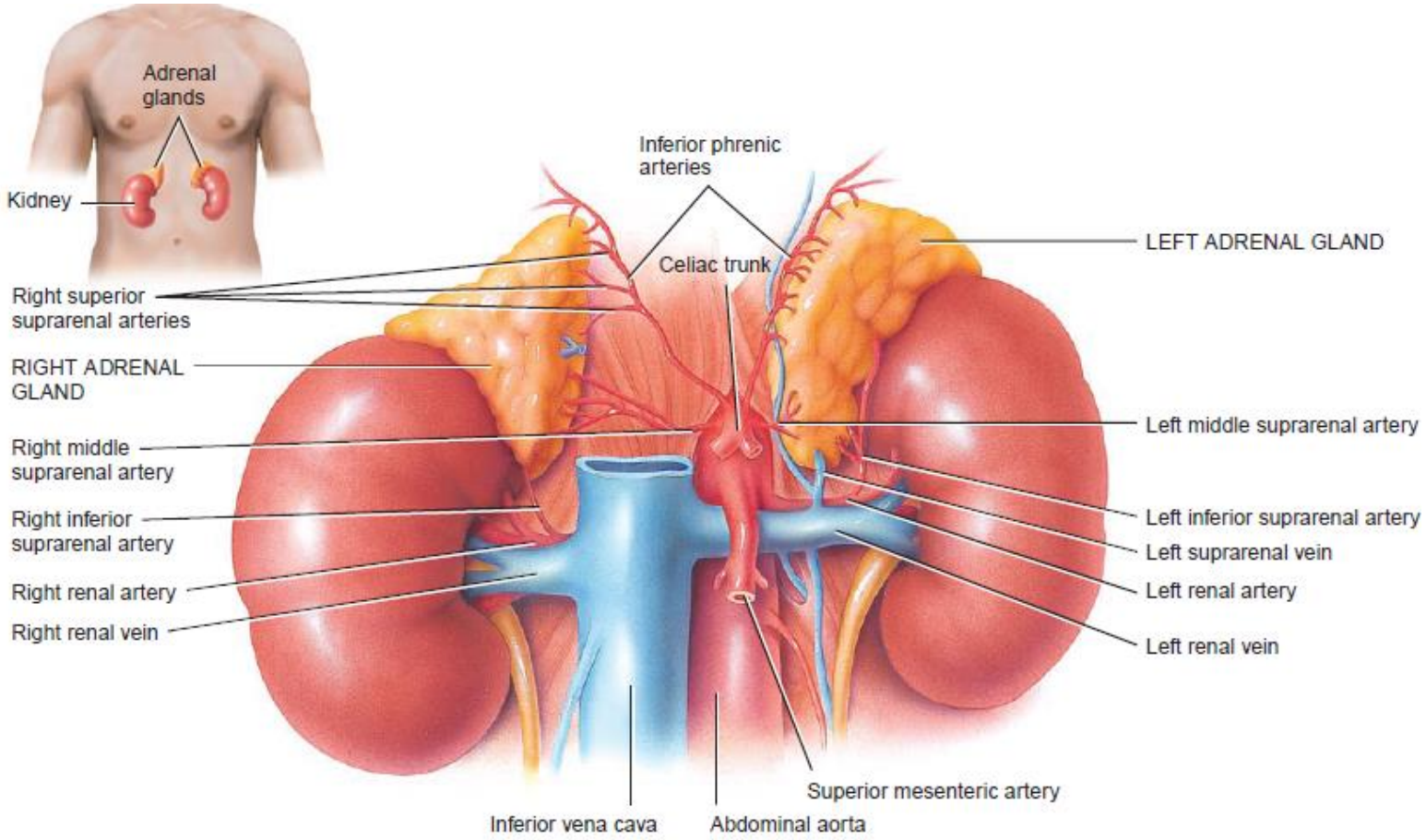



Microscopic section

# Anatomical Location and Structure

- **The adrenal glands are located in the posterior abdomen, between the superomedial kidney and the diaphragm.**
- **They are retroperitoneal, with parietal peritoneum covering their anterior surface only.**
- **The right gland is pyramidal in shape, contrasting with the semilunar shape of the left gland.**
- **Perinephric (or renal) fascia encloses the adrenal glands and the kidneys. This fascia attaches the glands to the crura of the diaphragm. They are separated from the kidneys by the perirenal fat.**

- **In an adult, each adrenal gland is 3–5 cm in height, 2–3 cm in width, and a little less than 1 cm thick, with a mass of 3.5–5 g, only half its size at birth.**




(a) Anterior view

# Anatomical Structure

**During embryonic development, the adrenal glands differentiate into two structurally and functionally distinct regions: a large, peripherally located adrenal cortex, comprising 80–90% of the gland, and a small, centrally located adrenal medulla.**

**A connective tissue capsule covers the gland.**

- **The adrenal glands, like the thyroid gland, are highly vascularized.**
- **The adrenal cortex produces steroid hormones that are essential for life.**
- **Complete loss of adrenocortical hormones leads to death due to dehydration and electrolyte imbalances in a few days to a week.**

## Cortex

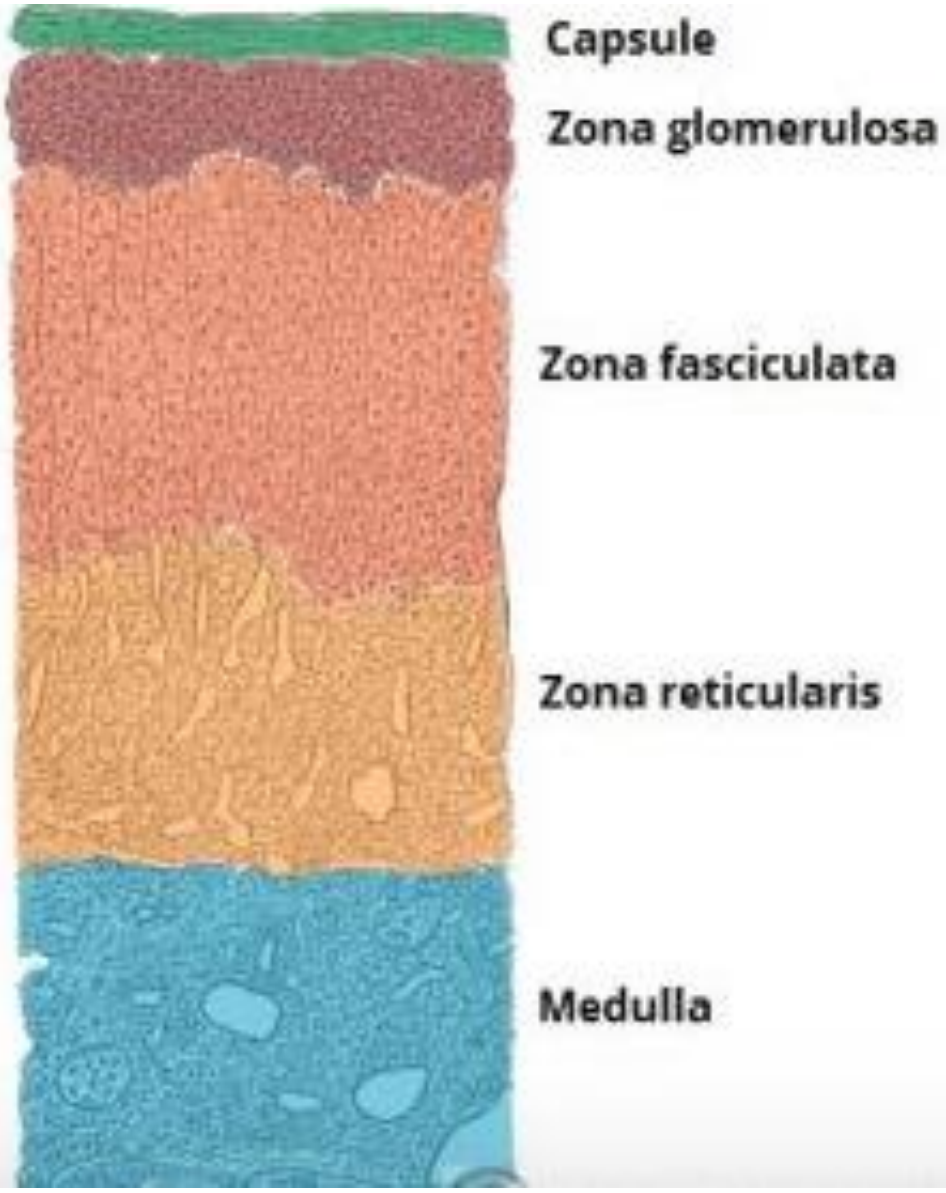
**The cortex is yellowish in colour. It secretes two hormones – corticosteroids and androgens. Functionally, the cortex can be divided into three regions (superficial to deep):**

- **Zona glomerulosa – produces and secretes mineralocorticoids such as aldosterone.**
- **Zona fasciculata – produces and secretes corticosteroids such as cortisol. It also secretes a small amount of androgens.**
- **Zona reticularis – They synthesize small amounts of weak androgens*, steroid hormones that have*** **masculinizing effects.**

## Medulla

- **The medulla lies in the centre of the gland, and is dark brown in colour.**
- **The inner region of the adrenal gland, the adrenal medulla, is a modified sympathetic ganglion of the autonomic nervous system (ANS)**
- **It contains chromaffin cells, which secrete catecholamines (such as adrenaline) into the bloodstream in response to stress.**
- **These hormones produce a ‘flight-or-fight‘ response.**

- **The two major hormones synthesized by the adrenal medulla are epinephrine and norepinephrine , also called *adrenaline and noradrenaline, respectively.***
- **The chromaffin cells of the adrenal medulla secrete an unequal amount of these hormones—about 80% epinephrine and 20% norepinephrine.**


Capsule
Zona glomerulosa
Zona fasciculata
Zona reticularis
Medulla

# Vasculature

**The adrenal glands have a rich blood supply via three main arteries:**

- **Superior adrenal artery – arises from the inferior phrenic artery**
- **Middle adrenal artery – arises from the abdominal aorta.**
- **Inferior adrenal artery – arises from the renal arteries.**

**Right and left adrenal veins drain the glands. The right adrenal vein drains into the inferior vena cava, whereas the left adrenal vein drains into the left renal vein.**

# Innervation

- **The adrenal glands are innervated by the coeliac plexus and greater splanchnic nerves.**
- **Sympathetic innervation to the adrenal medulla is via myelinated pre-synaptic fibres, mainly from the T10 to L1 spinal cord segments.**

**Lymphatics**

- **lumbar** lymph nodes

# Clinical Aspect

**Pheochromocytoma**

- **A pheochromocytoma is a tumour of the adrenal medulla. It secretes adrenaline and noradrenaline uncontrollably, causing blood pressure to greatly increase. Patients may present with palpitations, headaches and diaphoresis (profuse sweating).**

- **Cushing syndrome**
- **Addison's disease is caused by damage to adrenal glands, resulting in not enough of the hormone cortisol and, often, not enough aldosterone as well.**
- **Adrenal tumours**