Adrenal Physiology

What You Must Know

1. The adrenal glands are broadly divided into the cortex and medulla:
   a. The medulla secretes catecholamines, chiefly epinephrine.
   b. The cortex is divided into 3 zones:
      1. The zona glomerulosa (outer) secretes mineralocorticoids.
      2. The zona fasciculata secretes glucocorticoids.
      3. The zona reticularis (inner) secretes sex hormones.

2. Mineralocorticoids are released in response to hypovolemia, hyperkalemia and stimulation of the renin-angiotensin system.

3. Mineralocorticoids affect the distal tubule causing the retention of sodium and water with the concomitant urinary loss of potassium and hydrogen.

4. Glucocorticoid release is under the control of the hypothalamic-pituitary axis.

5. Glucocorticoids suppress the inflammatory response, stimulate gluconeogenesis, promote glycogenolysis, increase plasma glucose, decrease protein synthesis and possess mild mineralocorticoid effects.

6. The adrenal cortex also secretes small amounts of sex hormones, mainly androgens, which seem to be of minor physiologic significance in adults.

The adrenal cortex produces glucocorticoids, mineralocorticoids and sex hormones. The main hormones produced are cortisol, aldosterone and androgens. Cortisol is one of the major stress hormones and is released in response to the secretion of adrenocorticotropic hormone (ACTH) by the anterior pituitary, which is regulated by the release of corticotropin releasing factor (CRF) by the hypothalamus. Normal production and release of cortisol in the adult is approximately 20 mg/day. However, under periods of maximal stress, cortisol release may reach as high as 300 mg/day.

Aldosterone, also a stress hormone, causes the retention of sodium and water with resultant volume expansion. Aldosterone promotes the excretion of potassium and hydrogen ions. Excess aldosterone secretion thereby produces hypertension, plasma volume expansion and hypokalemic alkalosis. Although small amounts of aldosterone may be released in response to ACTH, aldosterone release is chiefly regulated by the renin-angiotensin system and serum potassium.

The adrenal medulla secretes epinephrine (80%), norepinephrine (20%) and dopamine (<1%). The adrenal medulla is innervated by preganglionic sympathetic nerve fibers and functions as a specialized sympathetic ganglia. It is the principal site of the conversion of tyrosine into catecholamines.

Additional Reading: