Lecture 7-Adrenal gland Pathology

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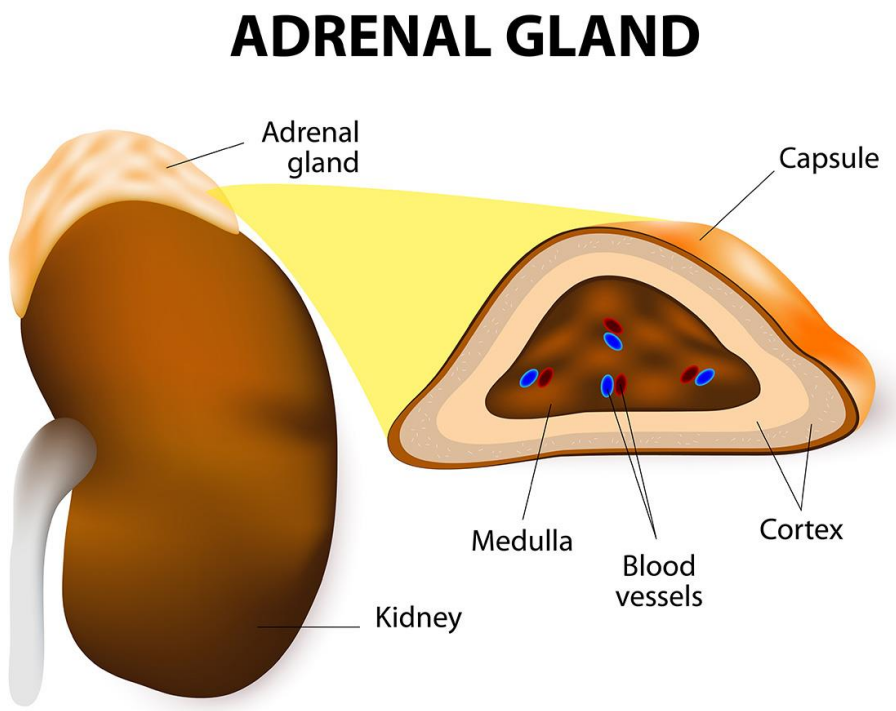
Adrenal gland

- الغُدَّةُ الكُظْرِيَّة
- **الغدة فوق الكلوية**



Adrenal glands

- The adrenal glands are paired endocrine organs consisting of two regions, the cortex and medulla, which differ in their development, structure, and function.
- The cortex consists of three layers of distinct cell types: zona glumerulosa, fasiculata, reticularis.

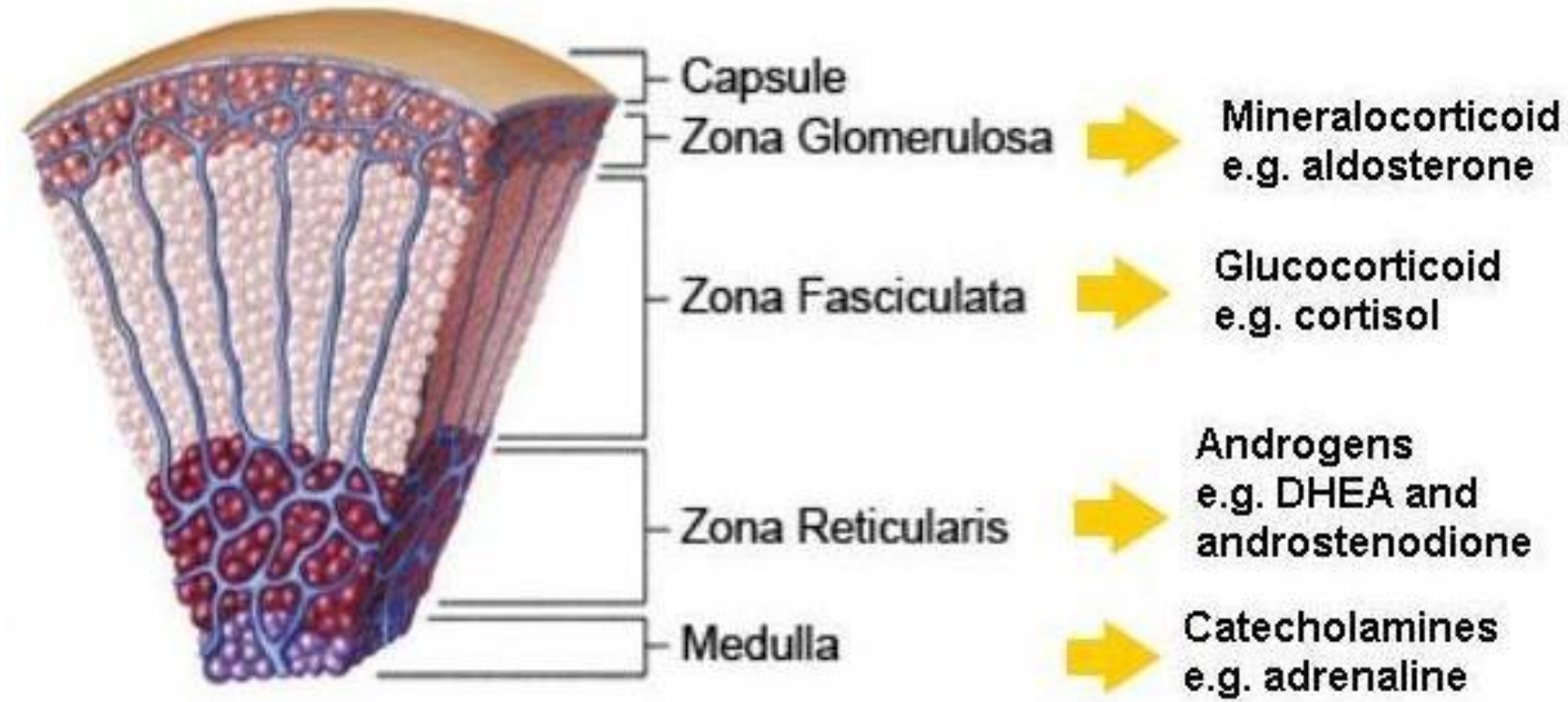
The adrenal cortex synthesizes three different types of steroids:

- glucocorticoids (principally cortisol), synthesized primarily in the zona fasciculata, with a small contribution from the zona reticularis
- Mineralocorticoids, the most important being aldosterone, secreted from zona glomerulosa
- Sex steroids (estrogens and androgens), produced largely in the zona reticularis

Adrenal medulla

- The adrenal medulla is composed of chromaffin cells, which synthesize and secrete catecholamines, mainly epinephrine.

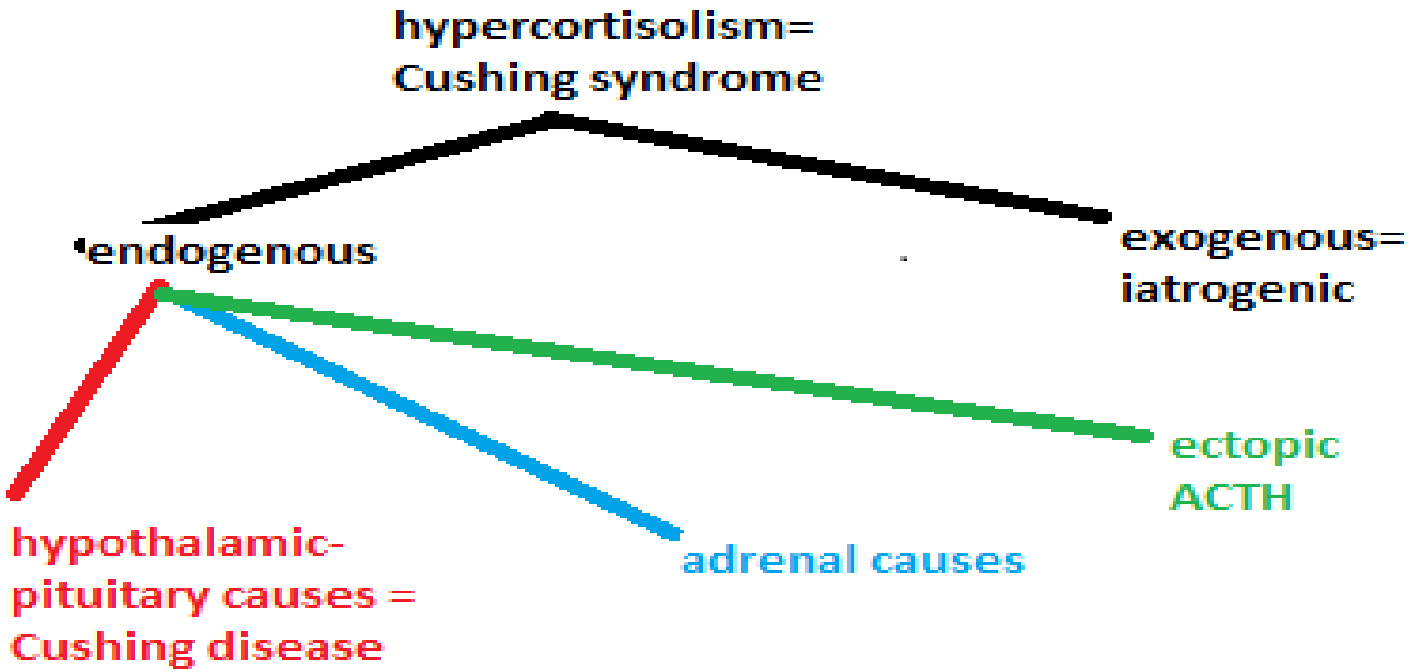
Adrenal gland



Adrenal cortex: same old story: mass effect and hormonal abnormalities.

- Hyperadrenalism :
  *Hypercortisolism,
  *hyperaldosteronism.
  *adrenogenital syndromes (will not be discussed here)
- Hypoadrenalism:
  *acute adrenal insufficiency
  *chronic adrenal insufficiency (Addison disease)
  *secondary adrenal insufficiency.
- Masses = Neoplasms
  * adenoma
  *carcinoma

hypercortisolism



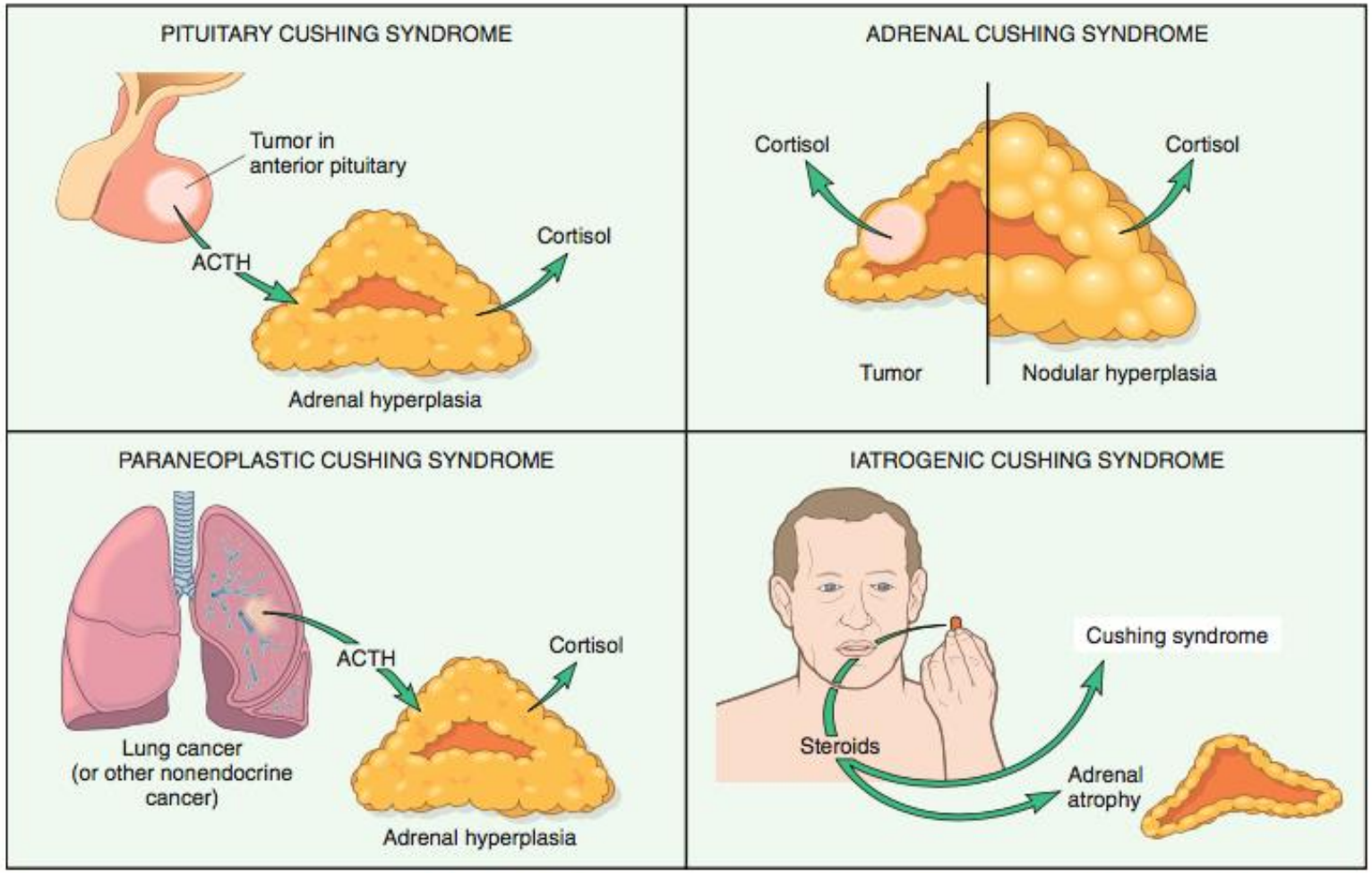
Hypercortisolism (Cushing Syndrome)

- Exogenous : if you treat patients with glucocorticoids (Iatrogenic) : this is the most common cause of Cushing syndrome.

- Endogenous causes

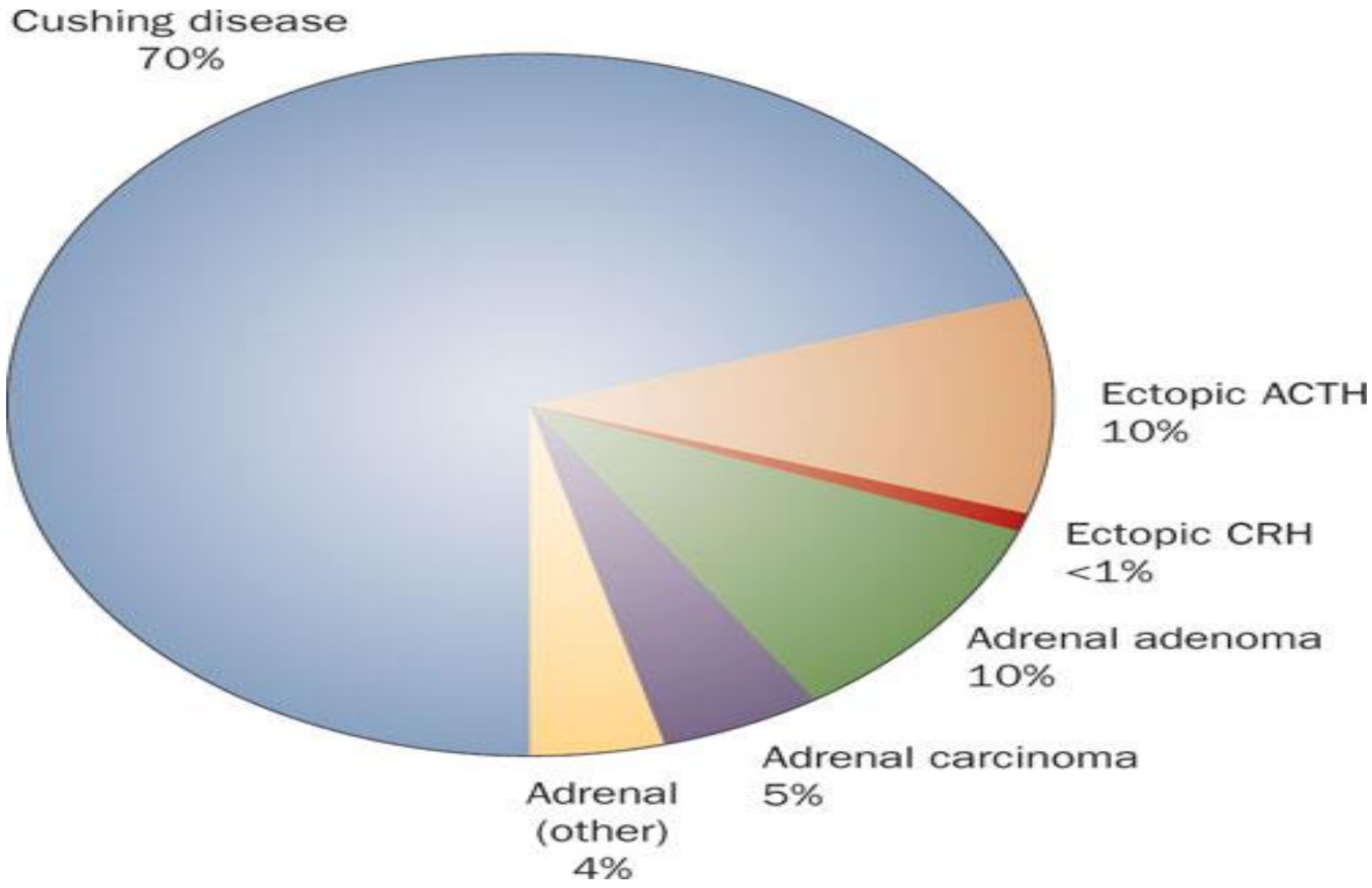
A. Hypothalamic-pituitary diseases causing hypersecretion of ACTH (Cushing disease)
B. Primary adrenal hyperplasia and neoplasms
C. Secretion of ectopic ACTH by nonpituitary tumors

Cushing syndrome



ig. 20.34 Schematic representation of the various forms of Cushing syndrome: The three endogenous forms, as well as the more common exogenous atrogenic) form. *ACTH*, Adrenocorticotropic hormone.

Causes of endogenous Cushing syndrome



Iatrogenic Cushing: effect on the adrenals

- In patients in whom the syndrome results from exogenous glucocorticoids, suppression of endogenous ACTH results in bilateral cortical atrophy, due to a lack of stimulation of the zona fasciculata and zona reticularis by ACTH.

HYPOTHALAMIC- PITUITARY CAUSES CUSHING DISEASE

-70% of cases of spontaneous, endogenous Cushing syndrome are due to Cushing disease.

- Occurs most frequently during young adulthood (the 20s and 30s)
- mainly affecting women.

CUSHING DISEASE

-majority of cases are due to pituitary ACTH-producing *adenoma*

- In the remaining patients, the anterior pituitary contains areas of *corticotroph cell hyperplasia* which may be: primary or, less commonly, secondary to CRH producing tumor

MORPHOLOGY

The adrenal glands in Cushing disease show bilateral cortical hyperplasia secondary to the elevated levels of ACTH ("ACTH-dependent" Cushing syndrome).

Because ACTH is high.. There is hyperplasia of the adrenals which is usually diffuse but can be nodular.

Diffuse hyperplasia

- Diffuse hyperplasia is found in patients with ACTH- dependent Cushing syndrome .
- Both glands are enlarged, either subtly or markedly, each weighing up to 30 g.
- The yellow colour of diffusely hyperplastic glands derives from the presence of lipid-rich cells, which appear vacuolated under the microscope.

Diffuse cortical hyperplasia

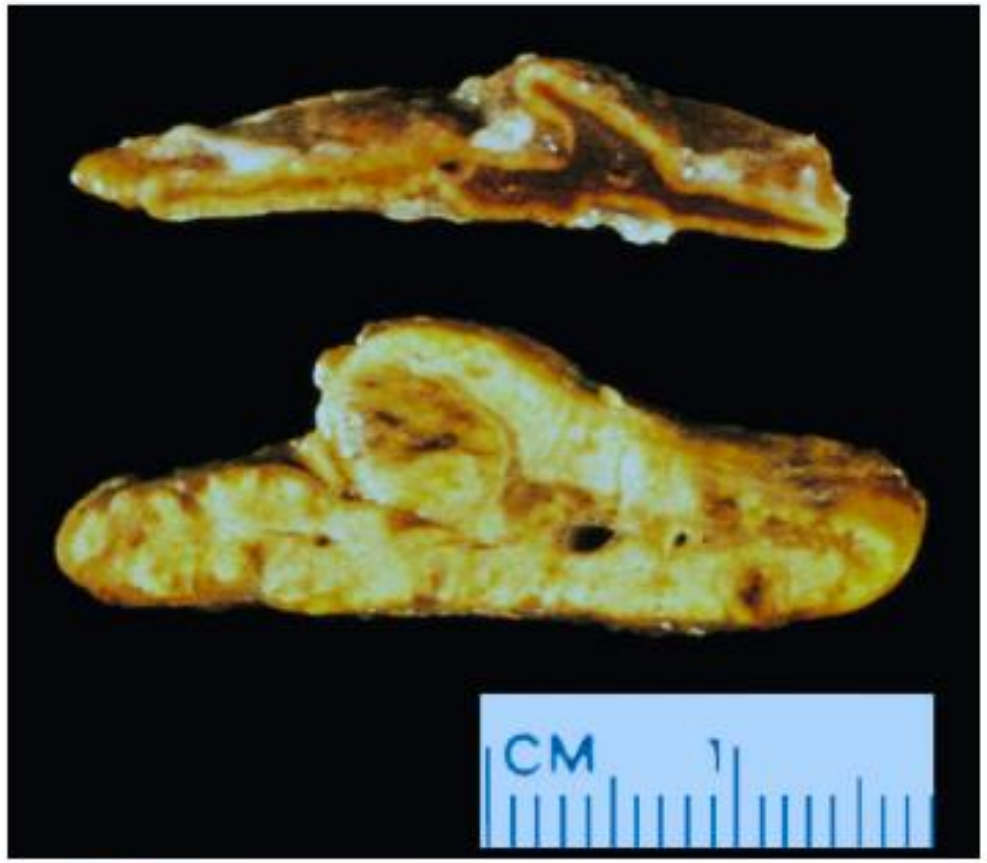


Fig. 20.35 Diffuse hyperplasia of the adrenal gland *(bottom)* contrasted with a normal adrenal gland *(top)*. In a cross-section, the adrenal cortex is yellow and thickened, and a subtle nodularity is evident. The abnormal gland was from a patient with ACTH-dependent Cushing syndrome, in whom both adrenal glands were diffusely hyperplastic. *ACTH*, Adrenocorticotropic

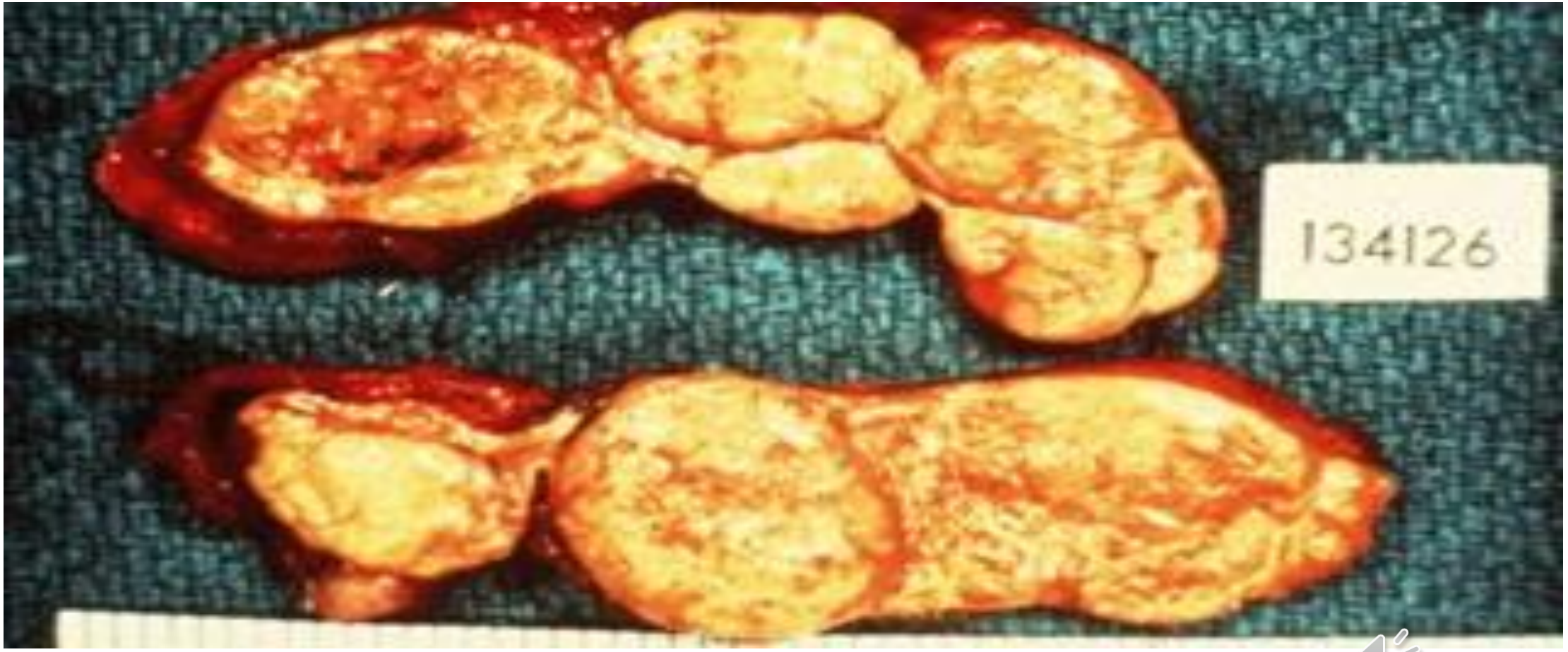
PRIMARY ADRENAL HYPERPLASIA AND NEOPLASMS

- 10% to 20% of cases of endogenous Cushing syndrome are due to primary diseases in the adrenal gland.
- *This is called ACTH-independent Cushing syndrome*, because of the low serum levels of ACTH
- It is caused by adrenal adenoma or carcinoma.
- Can also be caused by primary hyperplasia but this is very rare.

Primary adrenal hyperplasia

- In primary cortical hyperplasia, the cortex is replaced almost entirely by macronodules or 1- to 3-mm micronodules.

Nodular cortical hyperplasia



ECTOPIC ACTH BY NONPITUITARY TUMORS

- mostly caused by *small cell carcinoma of the lung*,
- The adrenal glands undergo bilateral hyperplasia due to elevated ACTH,

Primary adrenocortical neoplasms

- Are more common in women in their 30s to 50s.

a. Adrenocortical adenomas: Are yellow tumors surrounded by thin capsules, and most weigh less than 30 g

b. Carcinomas tend to be nonencapsulated masses , exceeding 200 to 300 g in weight,

Adrenocortical adenoma

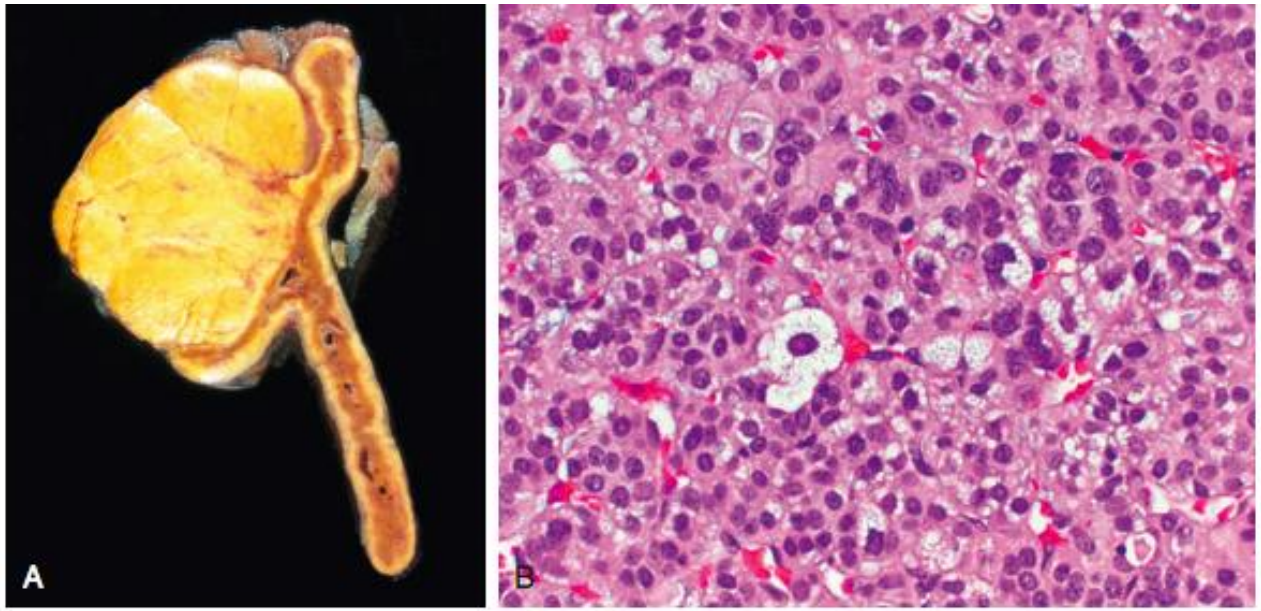


Fig. 20.37 Adrenocortical adenoma. (A) The adenoma is distinguished from nodular hyperplasia by its solitary, circumscribed nature. The functional status of an adrenocortical adenoma cannot be predicted from its gross or microscopic appearance. (B) Histologic features of an adrenal cortical adenoma. The neoplastic cells are vacuolated because of the presence of intracytoplasmic lipid. There is mild nuclear pleomorphism. Mitotic activity and necrosis are not seen.

CLINICAL MANIFESTATIONS OF CUSHING SYNDROME

a. Hypertension and weight gain
b. truncal obesity, "moon facies,“ accumulation of fat in the posterior neck and back ("buffalo hump") .
c. Glucocorticoids induce gluconeogenesis with resultant *hyperglycemia, glucosuria,* and *polydipsia,*
d. The catabolic effects on proteins cause loss of collagen and resorption of bone and bone resorption results in *osteoporosis and* susceptibility to fractures.

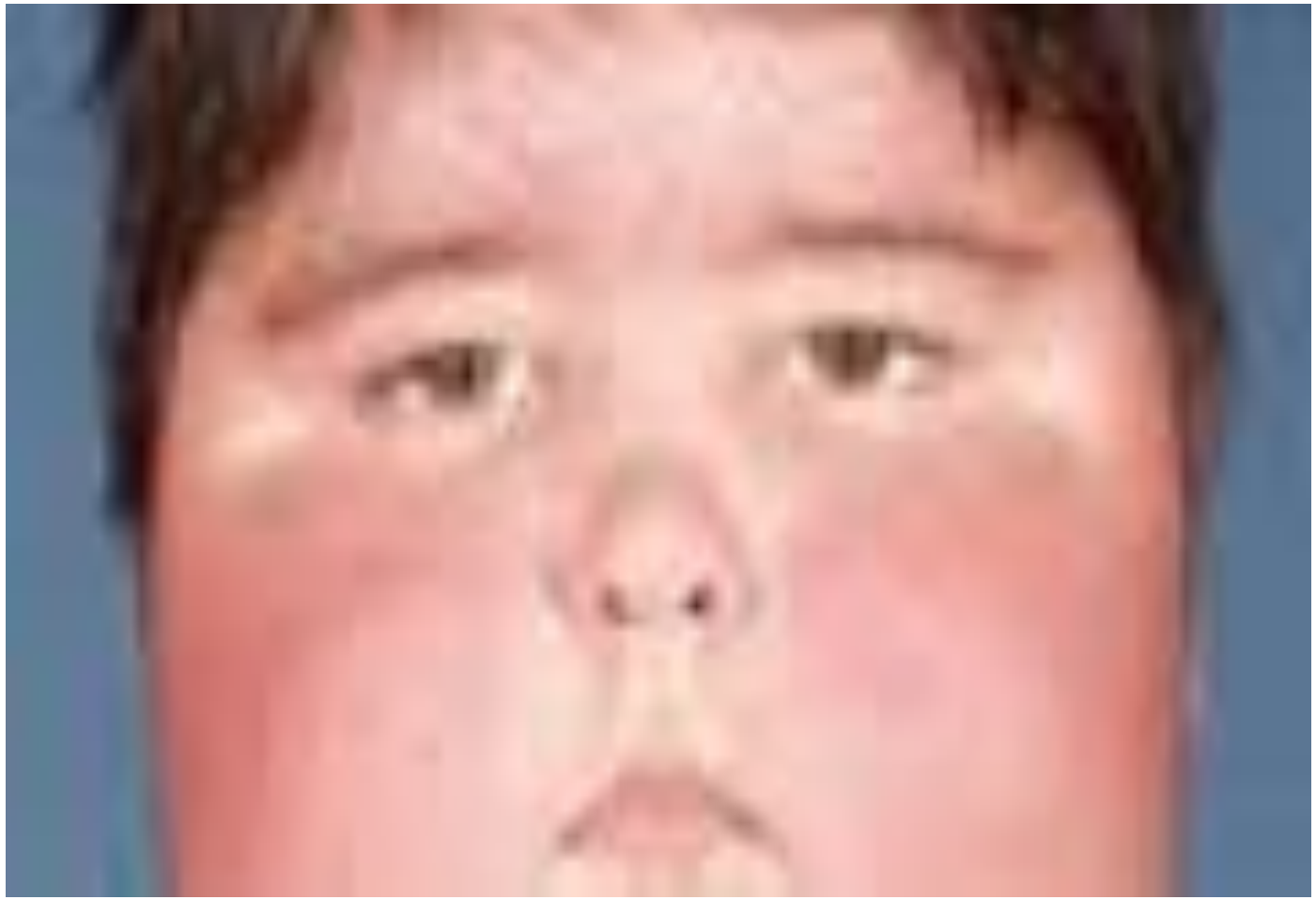
e.The skin is thin, fragile, and easily bruised; cutaneous striae are particularly common in the abdominal area

f. Patients are at increased risk for a variety of infections.

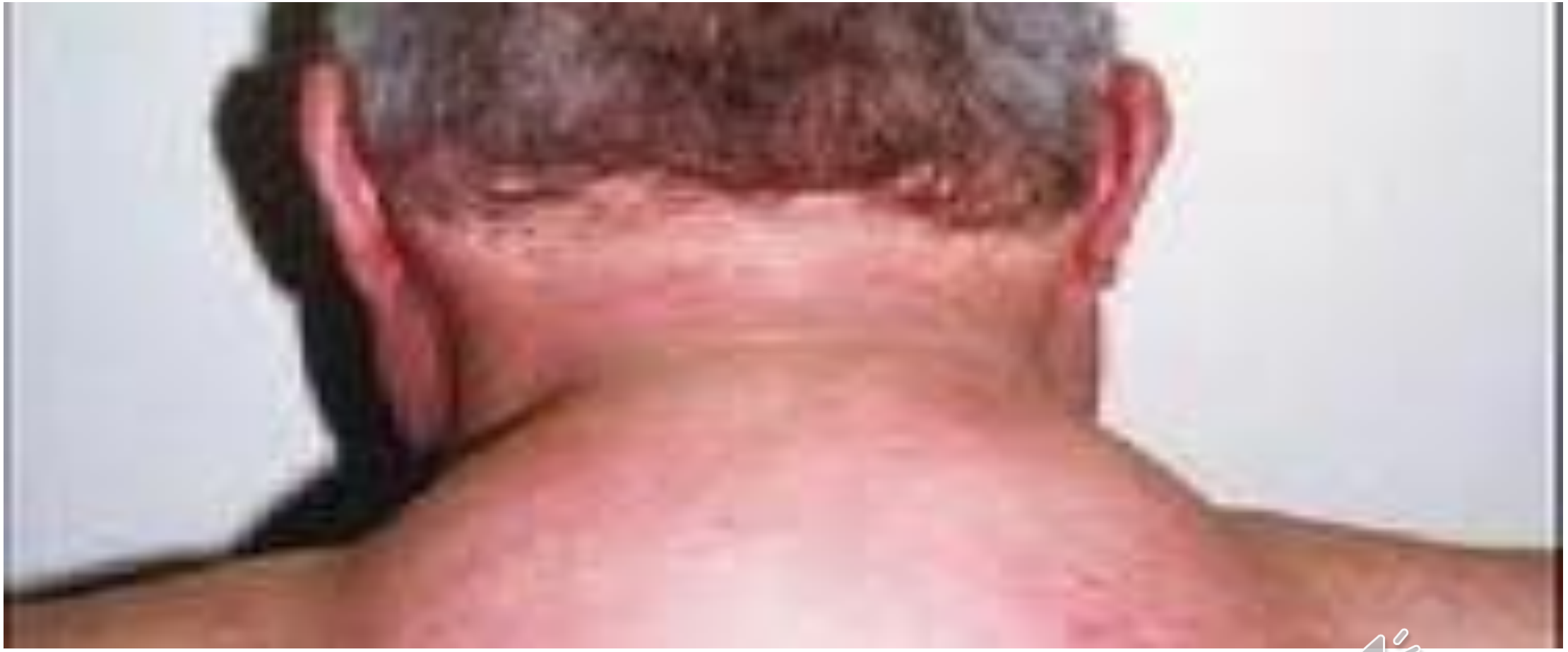
g. Hirsutism and menstrual abnormalities

h. Mental disturbances ,mood swings, depression, psychosis

Moon face

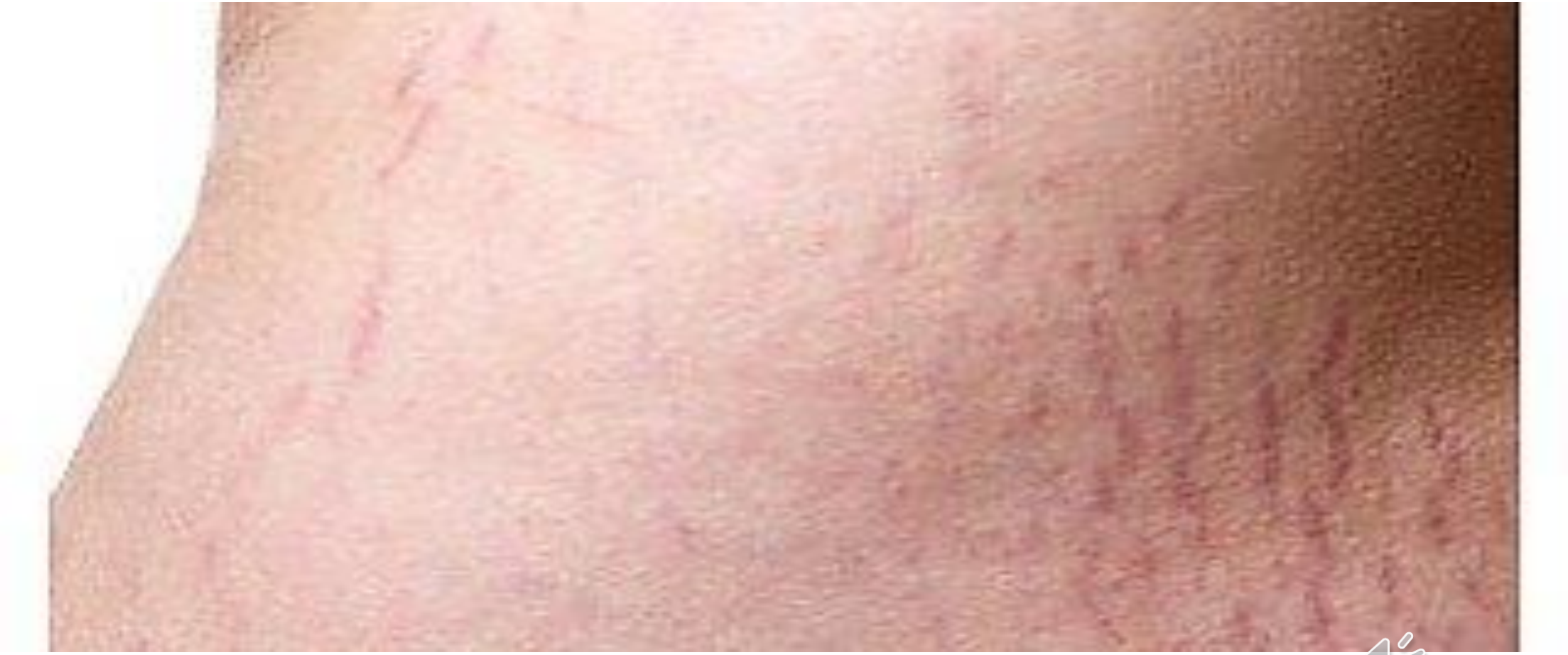


Buffalo hump



buffalo

stria



aldosterone

- The **renin–angiotensin–aldosterone system** (**RAAS**) is a hormone system that is involved in the regulation of the plasma sodium concentration and arterial blood pressure.

HYPERALDOSTERONISM

Primary hyperaldosteronism:

- autonomous overproduction of aldosterone with secondary suppression of renin- angiotensin system and decreased plasma renin activity

Secondary hyperaldosteronism:

- Secondary to activation of renin-angiotensin system characterized by increased levels of plasma renin

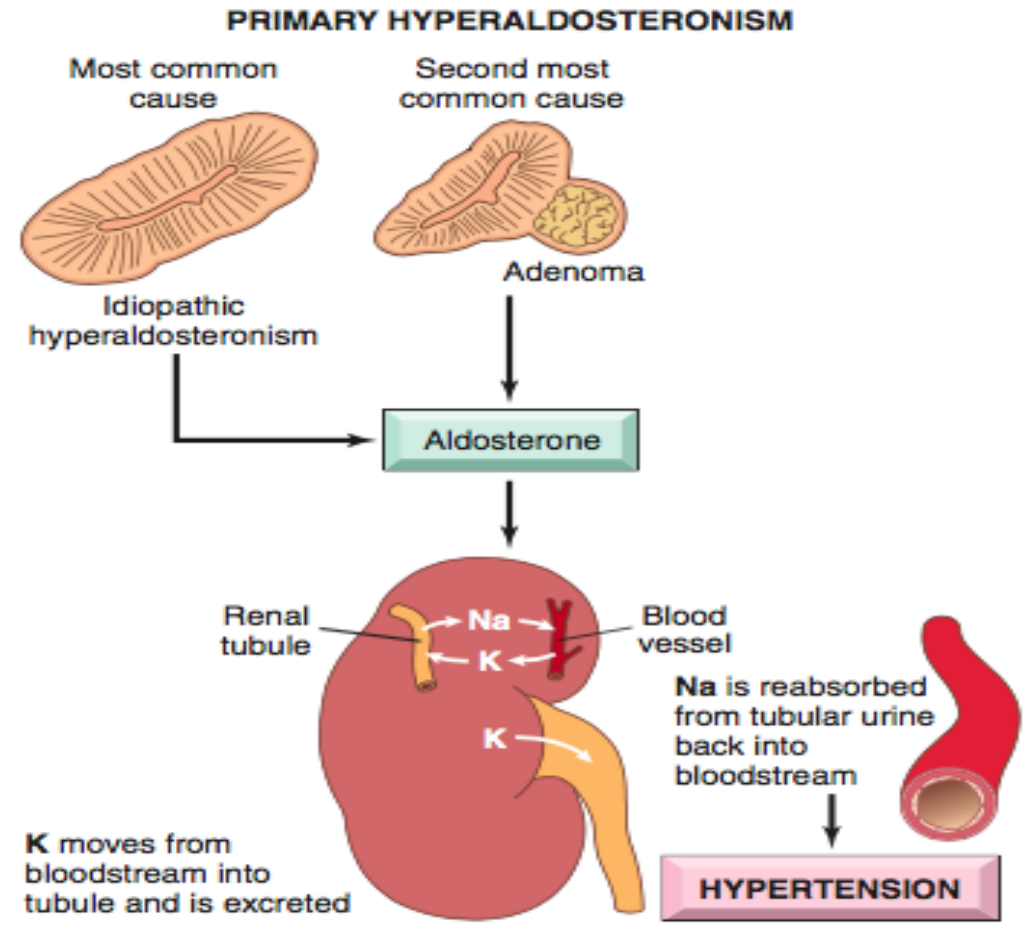


Fig. 20.39 The major causes of primary hyperaldosteronism and its principal effects on the kidney.

CAUSES OF SECONDARY HYPERALDOSTERONISM

a. Decreased renal perfusion(renal artery stenosis)

b. Arterial hypovolemia and edema e.g heart failure

c. Pregnancy (caused by estrogen-induced increases in plasma renin substrate