Revised & Approved

Bassam Alasmari
Rania Almutiri

3

Any future corrections will be in the editing file , Click

Pathology

Pathology of adrenal gland

439

Color index

- Important
- Doctor's note
- Extra info
- Main text
- ★ Male's slide
- ★ Female's slide

اللهم لا سهل الا ماجعلته سهلا و انت
تجعل الحزن إذا شئت سهلا

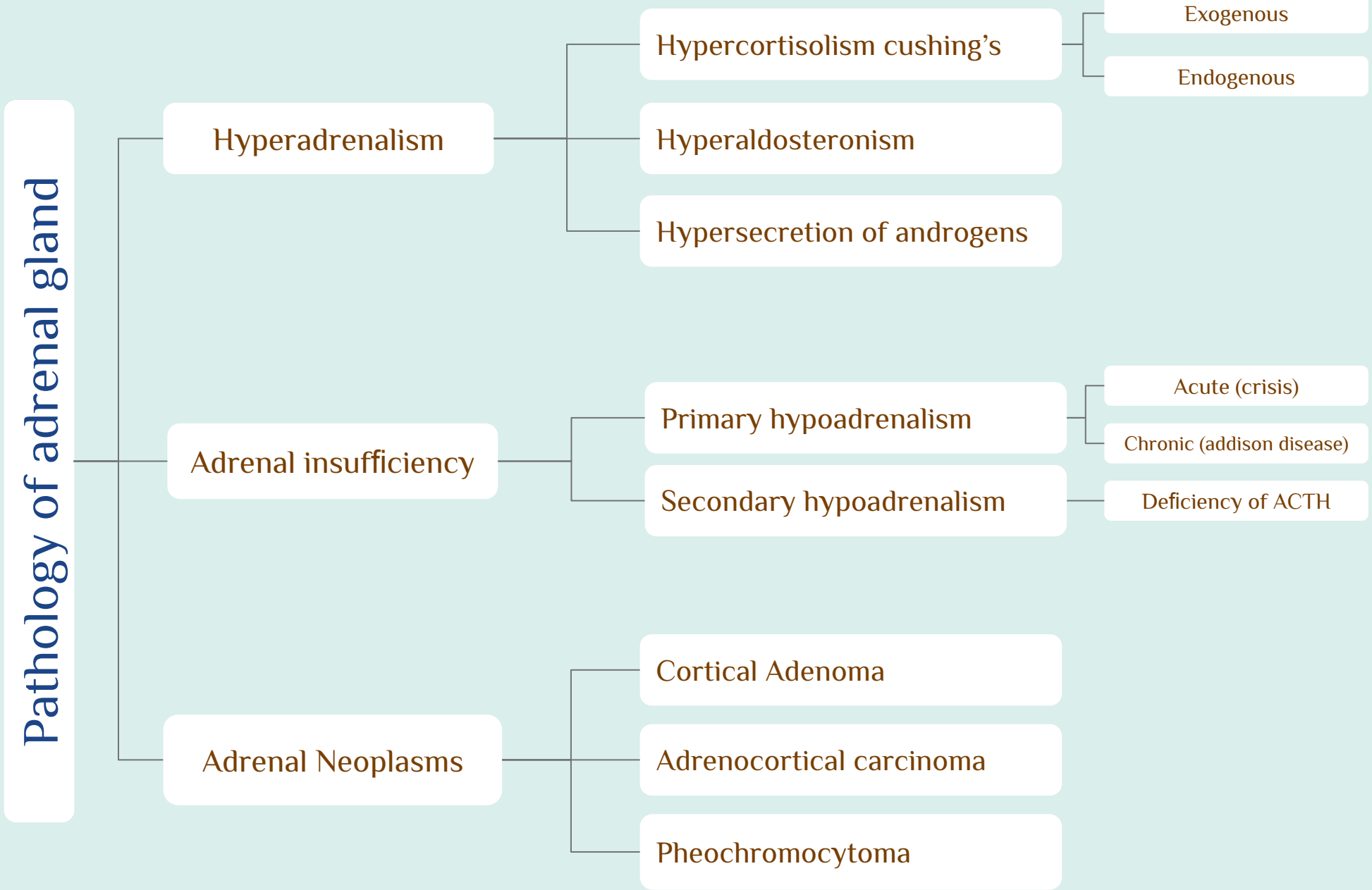
Objective

01 Understand the structure and function of adrenal glands

02 Know the disorders that can cause hypo or hyper function of the adrenal cortex

03 Understand the histopathological features of both medullary (pheochromocytoma) and adrenocortical neoplasms

Overview



HYPERADRENALISM : Adrenocortical Hyperfunction

There are three distinctive hyperadrenal clinical syndromes, each caused by abnormal production of one or more of the hormones produced by the three layers of the cortex:

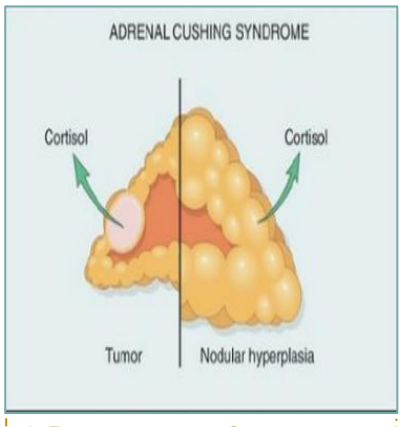
- Cushing syndrome characterized by an excess of cortisol
- hyperaldosteronism (excess aldosterone)
- adrenogenital or virilizing syndromes : caused by an excess of androgens

Cushing Syndrome

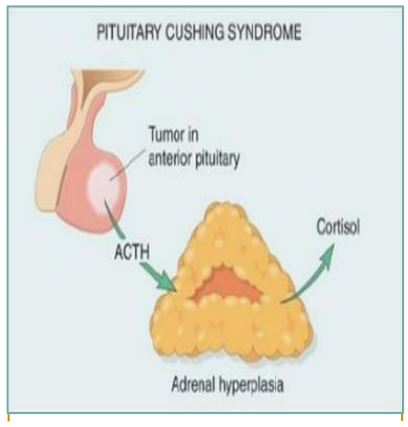
It is broadly divided into exogenous and endogenous causes.

- The vast majority of cases of Cushing syndrome are the result of the administration of **exogenous** glucocorticoids ("iatrogenic = related to treatment" Cushing syndrome). Most of the cases that are related to exogenous glucocorticoids we call them iatrogenic cushing syndrome. Occurs as a result of long-term administration of glucocorticoids in people with different types of chronic diseases, e.x: rheumatoid arthritis and SLE . It is the **most common cause** of cushing syndrome.

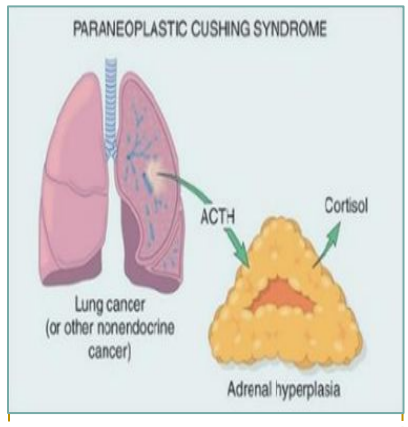
- The **endogenous** causes can be either:
  - ACTH dependent (comes from the pituitary, cortisol increases as a response of increased ACTH)
    - **Cushing disease** (pituitary adenoma (70% of ACTH dependent cases), Rarely CRH- dependent pituitary hyperplasia)
    - **Ectopic corticotropin Syndrome** (ACTH-secreting pulmonary small-cell carcinoma, bronchial carcinoid)
  - ACTH independent (the problem is primarily in the adrenal gland)
    - **Adrenal adenoma**
    - **Adrenal Carcinoma**
    - **Macronodular hyperplasia** (ectopic expression of hormone receptors, including GIPR, LHR, Vasopressin and serotonin)
    - **Primary pigmented nodular adrenal disease** (PRKARIA and PDE11 mutations)
    - **McCune-Albright syndrome** (GNAS mutation)



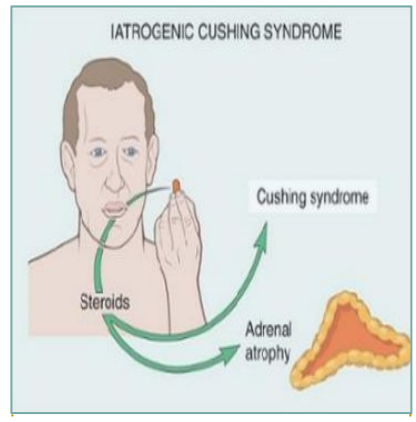
1. Primary neoplasm in the adrenal gland → secretes cortisol → inhibits ACTH secretion → no hyperplasia of the adjacent adrenal gland.
2. Primary nodular hyperplasia of the cortex with the secretion of cortisol



Other common situation: adenoma of pituitary secreting ACTH → continuous stimulation of the adrenal gland → adrenal hyperplasia and increased cortisol



Ectopic secretion (lung cancer that will secrete ACTH)



Administration of cortisone → excessive cortisol level → -ve feedback on the ACTH cells → low ACTH → no stimulation of adrenal gland → adrenal atrophy

Cause	Relative Frequency (%)	Ratio of Females to Males
ACTH-DEPENDENT		
Cushing disease (pituitary adenoma; rarely CRH-dependent pituitary hyperplasia)	70	3.5:1.0
Ectopic corticotropin syndrome (ACTH-secreting pulmonary small-cell carcinoma, bronchial carcinoid)	10	1:1
ACTH-INDEPENDENT		
Adrenal adenoma	10	4:1
Adrenal carcinoma	5	1:1
Macronodular hyperplasia (ectopic expression of hormone receptors, including GIPR, LHR, vasopressin and serotonin receptors)	<2	1:1
Primary pigmented nodular adrenal disease (PRKAR1A and PDE11 mutations)	<2	1:1
McCune-Albright syndrome (GNAS mutations)	<2	1:1

1. Cushing disease

- (Primary hypothalamic-pituitary disease associated with hypersecretion of ACTH)
- It accounts for approximately 70% of cases of spontaneous, endogenous Cushing syndrome.
- It is four times higher among women than among men
- In the vast majority of cases, the pituitary gland contains an ACTH-producing microadenoma that does not produce mass effects in the brain because it's small
- The adrenal glands in patients with Cushing disease show variable degrees of bilateral (both glands are responding to the increased ACTH levels) nodular cortical hyperplasia , secondary to the elevated levels of ACTH ("ACTH-dependent" Cushing syndrome)

2. Ectopic ACTH

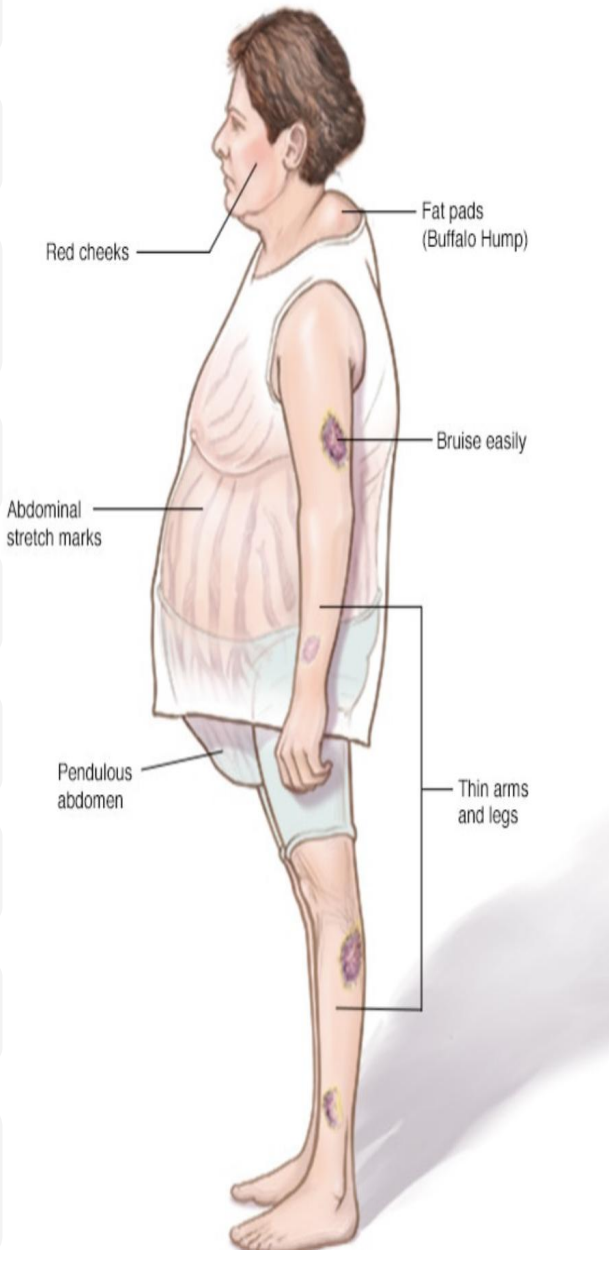
- Secretion of ectopic ACTH by non-pituitary tumors accounts for about 10% of cases of Cushing syndrome (2nd most common cause of ACTH dependent)
- In many instances the responsible tumor is a small-cell carcinoma of the lung, although other neoplasms, including carcinoids, medullary carcinomas of the thyroid, and PanNETs, have been associated with the syndrome
- As in the pituitary variant, the adrenal glands undergo bilateral cortical hyperplasia secondary to elevated ACTH

3. Neoplasms and hyperplasia

- Neoplasms either adenoma or carcinoma. Hyperplasia are less common
- Primary adrenal neoplasms, such as adrenal adenoma and carcinoma, and rarely, primary cortical hyperplasia, are responsible for about 15% to 20% of cases of endogenous Cushing syndrome, also designated ACTH-independent Cushing syndrome
- Primary cortical hyperplasia of the adrenal cortices is a rare cause of Cushing syndrome. There are two variants of this entity; the first presents as macro nodules of varying sizes (typically less than 3 cm in diameter) and the second as micronodules (1–3 mm).

Clinical features

- Hypertension and weight gain
- **Truncal obesity**, “moon facies,” and accumulation of fat in the posterior neck and back (“buffalo hump”)
- Proximal limb weakness. (atrophy of type 2 fibers)
- Glucocorticoids induce gluconeogenesis and inhibit the uptake of glucose by cells, with resultant hyperglycemia, glucosuria,and polydipsia, mimicking diabetes mellitus
- Osteoporosis, with consequent increased susceptibility to fractions
- Mental disturbances, including mood swings, depression, and frank psychosis
- The skin is thin, fragile, and easily bruised; cutaneous striae .
- Increased risk for a variety of infections.
- **Hirsutism** and menstrual abnormalities (amenorrhea)
- Extra-adrenal Cushing syndrome caused by pituitary or ectopic ACTH secretion usually is associated with increased skin pigmentation secondary to melanocyte-stimulating activity in the ACTH precursor molecule.



Investigation

- In pituitary and ectopic Cushing syndrome, ACTH levels are elevated and the urine is characterized by high levels of excreted corticosteroids
- In contrast, ACTH levels are low in Cushing syndrome secondary to adrenal tumors

Morphology

Exogenous cause

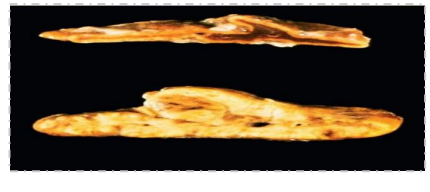
Cortical atrophy: results from **exogenous** glucocorticoids

ACTH-dependent

Diffuse hyperplasia: found in all individuals with **ACTH-dependant Cushing's syndrome** (ectopic or pituitary)

Primary Cortical Hyperplasia

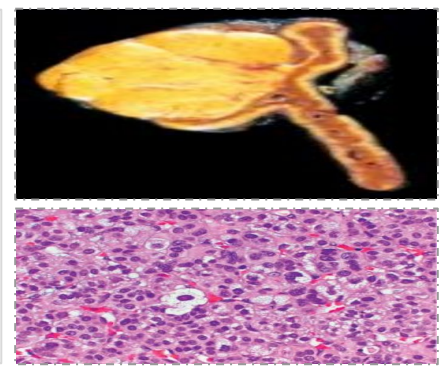
Cortex replacement by macronodules or 1-3mm darkly pigmented micronodules (pigment is believed to be lipofuscin, which is a wear-and-tear pigment if you remember): found in **Primary Cortical Hyperplasia**



Adenoma (A) or Carcinoma (B)

Functional adenomas or carcinomas of the adrenal cortex are not morphologically distinct from non-functioning adrenal neoplasms

(A) **Grossly** :
-Adrenocortical adenomas are yellow tumors surrounded by thin or well-developed capsules, and most weigh less than 30g.
-The adenoma is distinguished from nodular hyperplasia by its solitary, circumscribed nature
Microscopically :
-They are composed of cells similar to those encountered in the normal zona fasciculata
-Neoplastic cells are vacuolated because of the presence of intracytoplasmic lipid. There is mild nuclear pleomorphism. Mitotic activity and necrosis are not seen



(B) - Carcinomas are non encapsulated masses frequently exceeding 200 to 300 g in weight (large), having all of the anaplastic characteristics of cancer

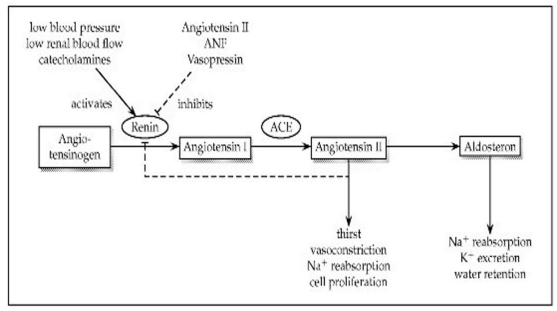
With functioning tumors, both benign and malignant, the adjacent adrenal cortex and that of the contralateral adrenal gland are atrophic, as a result of suppression of endogenous ACTH by high cortisol levels

The pituitary in Cushing syndrome shows changes that vary with different causes. The most common alteration, resulting from high levels of endogenous or exogenous glucocorticoids, is termed **Crooke hyaline change**. In this condition, the normal granula, basophilic cytoplasm of the ACTH-producing cells in the anterior pituitary is replaced by a homogeneous, lightly basophilic material. This alteration is the result of the accumulation of intermediate keratin filaments in the cytoplasm

Hyperaldosteronism

Chronic excess aldosterone secretion.

- **Primary aldosteronism** (autonomous overproduction of aldosterone) with resultant suppression of the renin-angiotensin system and decreased plasma renin activity.
- **Secondary hyperaldosteronism**, in contrast, aldosterone release occurs in response to activation of the renin-angiotensin system:
  - Decreased renal perfusion (activate secretion of aldosterone and water retention)
  - Arterial hypovolemia
  - Pregnancy



Causes

Causes of **Primary aldosteronism**:

- **Bilateral idiopathic hyperaldosteronism**, characterized by bilateral nodular hyperplasia of the adrenal glands. This is the most common underlying cause of primary hyperaldosteronism, accounting for about 60% of cases. The pathogenesis is unclear. Some have mutations in the KCNJ5 gene
- **Adrenocortical neoplasm**, either an aldosterone-producing adenoma or, rarely, an adrenocortical carcinoma. In approximately 35% of cases, primary hyperaldosteronism is caused by a solitary aldosterone-secreting adenoma, a condition referred to as **Conn syndrome**
- Rarely, familial hyperaldosteronism may result from a genetic defect that leads to overactivity of the aldosterone synthase gene, CYP11B2

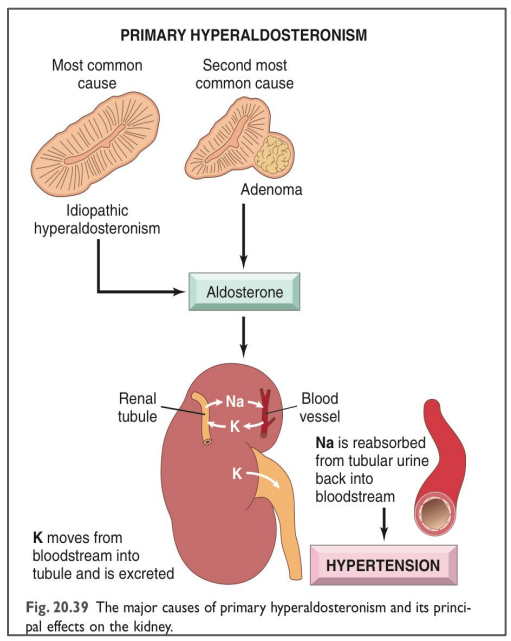


Fig. 20.39 The major causes of primary hyperaldosteronism and its principal effects on the kidney.

Clinical features

- Presents with **hypertension**.
- Primary hyperaldosteronism may be the most common cause of secondary hypertension (i.e., hypertension secondary to an identifiable cause) (Secondary hypertension can be corrected surgically. In this case, removal of the adenoma will correct the hypertension)
- Aldosterone promotes sodium reabsorption **(hypernatremia)**
- **Hypokalemia** results from renal potassium wasting and, when present, can cause a variety of neuromuscular manifestations, including weakness, paresthesias, visual disturbances.

Morphology

- **Aldosterone-producing adenomas** are almost always solitary, small (<2 cm in diameter), well-circumscribed lesions. They are bright yellow on cut section and are composed of lipid-laden cortical cells.
  - The cells tend to be uniform in size and shape; occasionally there is some nuclear and cellular pleomorphism.
  - A characteristic feature of aldosterone-producing adenomas is the presence of eosinophilic, laminated cytoplasmic inclusions, known as **spironolactone bodies**. These typically are found after treatment with the anti-hypertensive agent spironolactone, which is the drug of choice in primary hyperaldosteronism.

  In contrast with cortical adenomas associated with Cushing syndrome, those associated with hyperaldosteronism do not usually suppress ACTH secretion. Therefore, the adjacent adrenal cortex and that of the contralateral gland are not atrophic.
- **Bilateral idiopathic hyperplasia** is marked by diffuse or focal hyperplasia of cells resembling those of the normal zona glomerulosa.

Hypersecretion of sex steroids

The adrenal cortex can secrete excess androgens in either of two settings:

- Adrenocortical neoplasms (usually virilizing carcinomas)
- **Congenital adrenal hyperplasia (CAH):**
  - CAH consists of a group of autosomal recessive disorders characterized by defects in steroid biosynthesis, usually cortisol; the most common subtype is caused by deficiency of the enzyme **21-hydroxylase**.
  - Reduction in cortisol production causes a compensatory increase in ACTH secretion, which in turn stimulates androgen production.
  - The cortex can't produce cortisol because of 21 hydroxylase deficiency so instead it will produce androgens. Normally, androgens have no direct relation with ACTH.
  - Androgens have virilizing effects, including masculinization in females (ambiguous genitalia, oligomenorrhea, hirsutism), precocious (=increase in androgens) puberty in males
  - Cortisol deficiency places persons with CAH at risk for acute adrenal insufficiency because they have cortisol deficiency too .

Adrenocortical Insufficiency

Adrenocortical insufficiency, or hypofunction, may be caused by either:

- **Primary hypoadrenalism** (primary adrenal disease):
  - Acute (crisis)
  - chronic (Addison disease)
- **Secondary hypoadrenalism**: Decreased stimulation of the adrenals resulting from a deficiency of ACTH

Table 20.7 Causes of Adrenal Insufficiency

Acute
Waterhouse-Friderichsen syndrome
Sudden withdrawal of long-term corticosteroid therapy [1]
Stress in patients with underlying chronic adrenal insufficiency
Chronic
Autoimmune adrenalitis (60%–70% of cases in developed countries)—includes APS1 (*AIRE* mutations) and APS2 (polygenic)
Infections Tuberculosis Acquired immunodeficiency syndrome Fungal infections
Hemochromatosis
Sarcoidosis
Systemic amyloidosis
Metastatic disease

APS1, *APS2*, Autoimmune polyendocrine syndrome types 1 and 2; *AIRE*, autoimmune regulator gene.

Because of the gland atrophy. So, treatment withdrawal must be gradual

Waterhouse-Friderichsen syndrome

Definition	Bilateral adrenal hemorrhage in an infant with overwhelming sepsis, resulting in **acute** adrenal insufficiency.
Causes	It's is classically associated with **Neisseria meningitidis** septicemia but can also be caused by other organisms, including Pseudomonas spp., pneumococci, and Haemophilus influenzae.
Pathogenesis	The pathogenesis remains unclear but probably involves endotoxin-induced vascular injury with associated disseminated intravascular coagulation.
Morphology	At autopsy, the adrenals were grossly hemorrhagic and shrunken; in this photomicrograph, little residual cortical architecture is discernible.

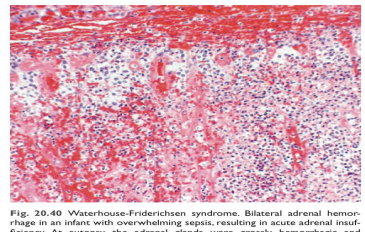


Fig. 20.40 Waterhouse-Friderichsen syndrome. Bilateral adrenal hemorrhage in an infant with overwhelming sepsis, resulting in acute adrenal insufficiency. At autopsy, the adrenal glands were grossly hemorrhagic and shrunken; in this photomicrograph, little residual cortical architecture is discernible.

Adrenocortical Insufficiency

Chronic Adrenocortical Insufficiency (Addison disease)

Definition	Uncommon disorder resulting from progressive destruction of the adrenal cortex.
Causes	More than 90% of all cases are attributable to one of four disorders: ❖ **Autoimmune adrenalitis** (most common cause) autoimmune destruction of steroid-producing cells, and autoantibodies. ❖ **Infection**: tuberculosis and fungal ❖ **Acquired immune deficiency syndrome (AIDS)** ❖ **Metastatic neoplasms**: Carcinomas of the lung and breast are the source of a majority of metastases in the adrenals.
Morphology	❖ **Primary autoimmune adrenalitis**: ➢ Grossly: characterized by irregularly shrunken glands, which may be exceedingly difficult to identify within the suprarenal adipose tissue. ➢ On histologic examination: the cortex contains only scattered residual cortical cells in a collapsed network of connective tissue. A variable lymphoid infiltrate is present in the cortex and may extend into the subjacent medulla ❖ In **tuberculosis or fungal diseases**, the adrenal architecture may be effaced by a granulomatous inflammatory reaction identical to that encountered in other sites of infection
Clinical features	❖ **Gastrointestinal disturbances** are common and include anorexia (loss of appetite), nausea, vomiting, weight loss, and diarrhea ❖ In patients with primary adrenal disease, increased levels of ACTH precursor hormone stimulate melanocytes, with resultant **hyperpigmentation** of the skin and mucosal surfaces ❖ Decreased mineralocorticoid (aldosterone) activity in patients with primary adrenal insufficiency results in potassium retention and sodium loss, with consequent **hyperkalemia**, hyponatremia, volume depletion, and **hypotension** ❖ Secondary hypoadrenalism is characterized by deficient cortisol and androgen output but normal or near-normal aldosterone synthesis ❖ **Hypoglycemia** occasionally may occur ❖ Stresses such as infections, trauma, or surgical procedures in affected patients may precipitate an acute adrenal crisis, manifested by intractable vomiting, abdominal pain, hypotension, coma, and vascular collapse. Death follows rapidly unless corticosteroids are replaced immediately

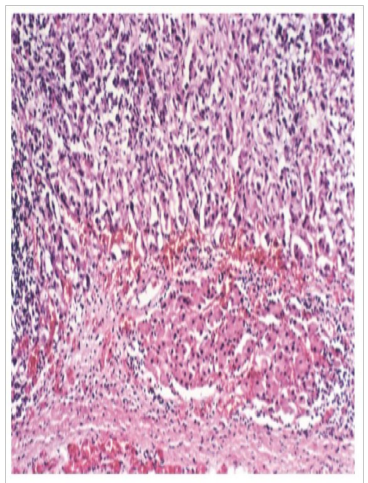
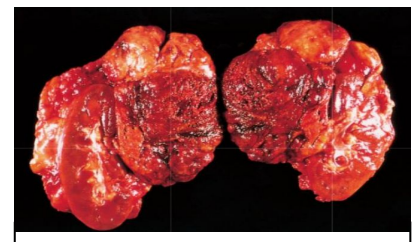
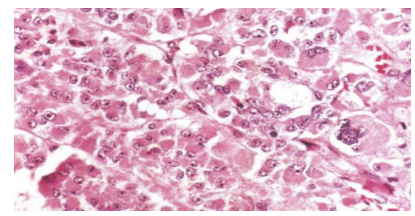


Fig. 20.41 Autoimmune adrenalitis. In addition to loss of all but a subcapsular rim of cortical cells, there is an extensive mononuclear cell infiltrate.

Adrenocortical Carcinomas

Definition	❖ While functional adenomas are most commonly associated with hyperaldosteronism and with Cushing syndrome, a virilizing (= related to androgens) neoplasm is more likely to be a carcinoma	
Cortical adenomas	❖ Most cortical adenomas do not cause hyperfunction and usually are encountered as incidental findings at the time of autopsy or during abdominal imaging for an unrelated cause	
	Grossly	❖ On cut surface, adenomas usually are yellow to yellow-brown, owing to the presence of lipid within the neoplastic cells ❖ As a general rule they are small, averaging 1 to 2 cm in diameter
	Microscopically	❖ adenomas are composed of cells similar to those populating the normal adrenal cortex. ❖ The nuclei tend to be small, although some degree of pleomorphism may be encountered even in benign lesions **(endocrine atypia)** ❖ The cytoplasm of the neoplastic cells ranges from eosinophilic to vacuolated, depending on their lipid content; mitotic activity generally is inconspicuous.
Adrenocortical carcinomas	❖ **Adrenocortical carcinomas** are rare neoplasms that may occur at any age, including in childhood.	
	Etiology	❖ Two rare inherited causes of adrenal cortical carcinomas are Li-Fraumeni syndrome and Beckwith-Wiedemann syndrome
	Grossly	❖ In most cases, adrenocortical carcinomas are large, invasive lesions that efface the native adrenal gland ❖ On cut surface, adrenocortical carcinomas typically are variegated, poorly demarcated lesions containing areas of necrosis, hemorrhage, and cystic change  Adrenal carcinoma. The tumor dwarfs the kidney and compresses the upper pole. It is largely hemorrhagic and necrotic
	Microscopically	❖ Anaplastic cells Cells are malignant (anaplastic) with prominent nucleoli, large number of mitoses, ugly looking cells 
Diagnosis	❖ Not all adrenocortical neoplasms, however, elaborate steroid hormones (some of them are silent) ❖ Determination of whether a cortical neoplasm is functional or not is based on clinical evaluation and measurement of the hormone or its metabolites in the laboratory	

Pheochromocytoma

Definition

- Neoplasms composed of chromaffin cells, which, like their nonneoplastic counterparts, synthesize and release catecholamines
- Similar to aldosterone-secreting adenomas, give rise to surgically correctable forms of hypertension.

Rule of 10s

Rule of 10s:

- 10% of pheochromocytomas are extraadrenal (paragangliomas)
- 10% of adrenal pheochromocytomas are bilateral; this proportion may rise to 50% in cases that are associated with familial syndromes.
- 10% of adrenal pheochromocytomas are malignant.
- 10% of adrenal pheochromocytomas are not associated with hypertension. However, it's the most common clinical symptom

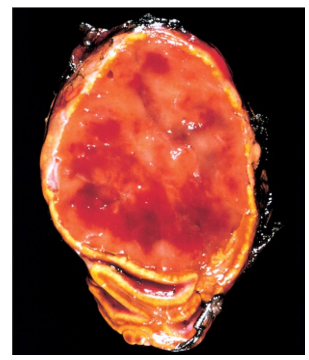
Genetics

- One "traditional" 10% rule that has since been modified pertains to familial cases.
- It is now recognized that as many as 25% of individuals with pheochromocytomas and paragangliomas harbor a germ line mutation in one of at least six known genes, including RET, which causes type 2 MEN syndromes ; NF1, which causes type 1 neurofibromatosis); VHL, which causes von Hippel-Lindau disease

Morphology

Gross:

- Pheochromocytomas range in size from small, circumscribed lesions confined to the adrenal to large, hemorrhagic masses weighing several kilograms.
- On cut surface, smaller pheochromocytomas are yellow-tan, well-defined lesions that compress the adjacent adrenal gland. Larger lesions tend to be hemorrhagic, necrotic, and cystic and typically efface the adrenal gland.



Pheochromocytoma. The tumor is enclosed within an attenuated cortex and demonstrates areas of hemorrhage. The comma-shaped residual adrenal gland is seen (lower portion).

Microscopy:

- polygonal to spindle-shaped chromaffin cells and their supporting cells, compartmentalized into small nests, or **Zellballen**, by a rich vascular network.
- The cytoplasm of the neoplastic cells often has a finely granular appearance.
- Electron microscopy reveals variable numbers of membrane-bound, electron-dense granules.
- How can you diagnose malignancy in pheochromocytoma? The nuclei of the neoplastic cells are often quite pleomorphic (so pleomorphism is not enough to diagnose malignancy) . Both capsular and vascular invasion may be encountered in benign lesions (so capsular and vascular invasion aren't enough variants), and the mere presence of mitotic figures does not imply malignancy. Therefore, **the definitive diagnosis of malignancy in pheochromocytomas is based exclusively on the presence of metastases**. These may involve regional lymph nodes as well as more distant sites, including liver, lung, and bone.

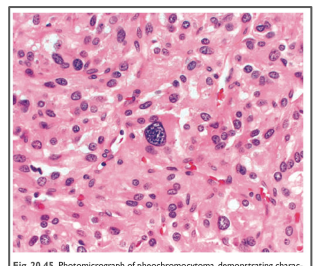
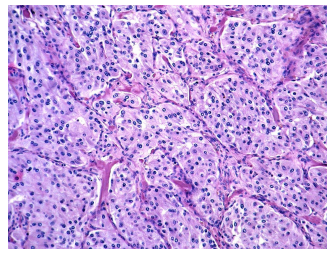


Fig. 20.45 Photomicrograph of pheochromocytoma, demonstrating characteristic nests of cells with abundant cytoplasm. Granules containing catecholamine are not visible in this preparation. It is not uncommon to find bizarre cells (such as the one in the center of this image), even in pheochromocytomas that are benign.



Clinical features

- The predominant clinical manifestation of pheochromocytoma is **hypertension**
- The characteristic presentation with a hypertensive episode is one of abrupt elevation in blood pressure, associated with tachycardia, palpitations, headache, sweating, tremor, and a sense of apprehension
- Increased risk of myocardial ischemia, heart failure, renal injury, and stroke (cerebrovascular accident) due to high blood pressure
- Sudden cardiac death may occur, probably secondary to catecholamine-induced myocardial irritability and ventricular arrhythmias
- The laboratory diagnosis of pheochromocytoma is based on demonstration of increased urinary excretion of free catecholamines and their metabolites, such as vanillylmandelic acid and metanephrines

Summary

Cushing syndrome

	Exogenous	Endogenous			
	glucocorticoids (iatrogenic) Most common	ACTH- dependent		ACTH- independent	
		Cushing disease 70%	Ectopic ACTH 10%	Adrenal adenoma 10%	Adrenal carcinoma 5%
Morphology	Cortical atrophy	Bilateral nodular cortical hyperplasia	Bilateral cortical hyperplasia	-Yellow tumors -Thin, well developed capsule -cell look normal -vacuolated neoplastic cell -no mitotic or necrotic activity	-non-capsulated -have anaplastic feature
Clinical feature	COH : anti insulin effect = hyperglycemia , redistribution of the fat : Truncal obesity, moon face , buffalo hump Catabolic effect of protein : Proximal limb weakness ,striae , easily bruised skin , Osteoporosis Increase androgen : Hirsutism , menstrual abnormalities Aldosterone like effect : hypertension				
		skin pigmentation			
Diagnosis		High level of ACTH in urine		Low level of ACTH in urine	
Note		ACTH-producing microadenoma	Usually caused by Small-Cell Carcinoma of the lung	Functional and nonfunctional tumors are not morphologically distinct	

Hyperaldosteronism

	Primary Hyperaldosteronism			Secondary Hyperaldosteronism
	idiopathic (Most common)	Adrenocortical neoplasm		-Decreased renal perfusion -Arterial hypovolemia -Pregnancy
		adenoma (conn syndrome)	carcinoma Rare	
Morphology	Bilateral nodular hyperplasia	-Solitary, well-circumscribed , Bright yellow on cut surface -nuclear and cellular pleomorphism -Spironolactone bodies (after treatment with spironolactone)		
	suppression of the renin-angiotensin system as negative feedback			activation of the RAAS system as causes
Clinical feature	- increase Na , H2O reabsorption ⟶ Secondary hypertension -decrease K level ⟶ neuromuscular manifestations -metabolic alkalosis			

Hypersecretion of androgens

	Adrenocortical neoplasms carcinoma	Congenital Adrenal Hyperplasia
		-deficiency in 21-Hydroxylase -increases ACTH secretion
Clinical feature	-In males: precocious puberty -In female: masculinization: ambiguous genitalia, oligomenorrhea, hirsutism	

Addison's disease

	Primary hypoadrenalism					Secondary hypoadrenalism
	acute (crisis)	chronic				deficiency of ACTH
	Water-Friderichsen syndrome Usually associated with Neisseria meningitidis septicemia	Autoimmune adrenalitis (most common cause)	Infection tuberculosis fungal	AIDS	Metastatic neoplasm	
Morphology	-Bilateral Adrenal haemorrhage and shrunken	-shrunken glands -Scattered residual cortical cells -Lymphoid infiltrate	-granulomatous -inflammatory reaction			
Clinical feature		-decrease aldosterone : hyperkalemia , hyponatremia , volume depletion , hypotension -hyperkalemia : cause GI disturbances (anorexia, nausea, vomiting, weight loss, diarrhea) -decrease cortisol level : Hypoglycemia				
Complication		acute adrenal crisis (Coma or death can follow if corticosteroids are not replaced)				

Pheochromocytoma

Definition	Neoplasms of chromaffin cells, which release catecholamines
Etiology	-Most often sporadic but associated with genetic syndromes in approximately 25% of cases **Genetic mutation** : Multiple endocrine neoplasia type 2 (MEN2) , Neurofibromatosis type 1 (NF1) , von Hippel-Lindau syndrome -Malignant in approximately 10% of cases
Morphology	-Vascular network form small nests (Zellballen) -cell : Polygonal to spindle shape -Cytoplasm: fine granular appearance -Nuclei : pleomorphic
Clinical feature	-Hypertension -tachycardia, palpitations, headache, sweating, tremor
Diagnosis	-increased urinary catecholamines -vanillylmandelic acid test -metanephrines test -Malignancy in pheochromocytomas is diagnosed by the presence of metastases

QUIZ!

MCQs

01 | A 5-year-boy has developed features that suggest puberty over the past 6 months. On physical examination, the boy has secondary sex characteristics, including pubic hair and enlargement of the penis. Which of the following morphologic features is most likely to be seen in his adrenal glands?			
A) Cortical Atrophy	B) Cortical Hyperplasia	C) medullary atrophy	D) medullary hyperplasia
02 | A 42-year-old woman presents with amenorrhea and emotional disturbances. You note upper truncal obesity and suspect Cushing syndrome. Laboratory studies reveal elevated serum levels of corticosteroids that can be lowered by administration of dexamethasone. Which of the following is the most likely cause of hypercortisolism in this patient?			
A) Adrenal cortical adenoma	B) Adrenal cortical carcinoma	C) Pheochromocytoma	D) Pituitary Adenoma
03 | A 40-year-old woman with a history of diabetes complains of recent changes in her bodily appearance. A photograph of the patient is shown in the image. Laboratory studies reveal elevated serum corticosteroids and low serum corticotropin. Administration of dexamethasone does not lower serum levels of corticosteroids. This patient most likely has a tumor that originates in which of the following anatomic locations?			
A) Adrenal cortex, zona fasciculata	B) Adrenal cortex, zona glomerulosa	C) Adrenal Medulla	D) Adrenal cortex, zona reticularis
04 | A 50-year-old man complains of muscle weakness and dizziness of 3 months in duration. His blood pressure is 185/100 mm Hg. Laboratory studies show hypernatremia and hypokalemia. Endocrine studies reveal elevated serum aldosterone and low renin and angiotensin. BUN is 24 mg/dL, and creatinine is 1.2 mg/dL. Endocrinologic studies rule out Cushing syndrome. Which of the following is the most likely cause of hypertension in this patient?			
A) Pheochromocytoma	B) Adrenogenital syndrome	C) Conn Syndrome	D) Chronic adrenal failure
05 | A 34-year-old man complains of sudden attacks of dizziness, blurred vision, and excruciating headaches of 4 months in duration. During one of these attacks, his blood pressure was 180/120 mm Hg. The patient's father had been treated for thyroid cancer about 15 years ago. Laboratory studies show normal serum levels of aldosterone, renin, and angiotensin. A 24-hour urinalysis reveals increased metanephrines. Episodic hypertension in this patient is most likely caused by a tumor in which of the following endocrine organs?			
A) Adrenal	B) Kidney	C) Pituitary	D)Parathyroid
06 | A 40-year-old man complains of nausea, vomiting, diarrhea, and cramping abdominal pain. His temperature is 38°C (101°F), blood pressure 90/60 mm Hg, and pulse rate 90 per minute. On physical examination, the patient appears dehydrated, with sunken eyeballs, dry tongue, and poor skin turgor. Hyperpigmentation is noted in the palmar creases and the gingival margins. Laboratory results include fasting serum glucose of 62 mg/dL (normal = 70 to 115 mg/dL), BUN of 27 mg/dL (normal = 11 to 23 mg/dL), Na of 122 mEq/L (normal = 136 to 145 mEq/L), and K of 6.5 mEq/L (normal = 3.5 to 5.0 mEq/L). Which of the following is the most likely cause of this patient's symptoms?			
A) Amyloidosis	B) Autoimmunity	C) Metastatic Cancer	D) Sarcoidosis

MCQs Answer key	01	02	03	04	05	06
	B	D	A	C	A	B

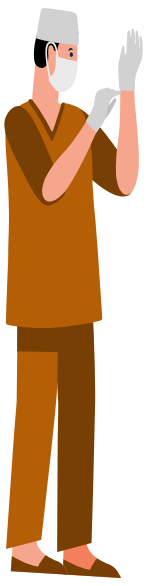
"اللهم علمنا ماينفعنا ، وانفعنا بما علمتنا وزدنا علما يارب العالمين"

Team leaders

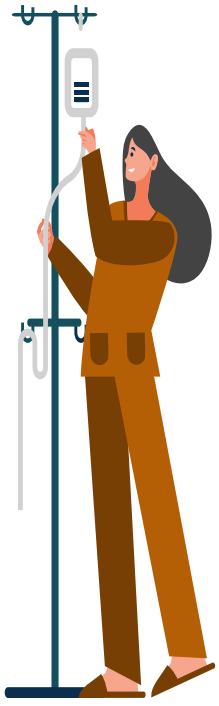
Hamad Almousa

Fatimah Alhilal

Team members



- Faisal Alfadel
- Hadi Alhemsi
- Abdulrahman Barashid
- Mansour Albawardy
- Ghada Alabdi
- Mariam Alruhaimi
- Renad Alhomaidi
- Rania almutiri
- Ghaida Almarshoud
- Ghadah Alsuwailem



This Lecture done by

- Organizer
- Member
- Note taker
- Reviser

Contact us through :
Pathology439@Gmail.com