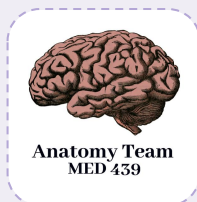


Anatomy & embryology of adrenal (suprarenal) gland

Editing File

Color index:

	Girls' slides		Boys' slides
	Main content		Extra
	Important		Drs' notes



Objectives:

- Location, shape and relations of the right and left adrenal glands.
- Blood supply, lymphatic drainage and nerve supply of right and left adrenal glands
- Parts of adrenal glands and function of each part.
- Development of adrenal gland and common anomalies.

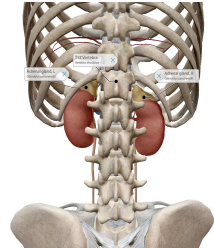
Anatomy of Suprarenal Glands

Definition

Also called the adrenal gland, the suprarenal gland is a component of the **hypothalamic-pituitary-suprarenal** (or **adrenal**) **axis** which is responsible for coordinating stress response and metabolism

Structure

- They are **yellowish retroperitoneal** (covered by peritoneum from the anterior surface as the kidneys) organs that lie on the upper poles of each kidney.
- They lie at the level of the last thoracic vertebra (T12)
- They are **surrounded by renal fascia**, but are separated from the kidneys by the **perirenal fat** that allow the two organs to be separated easily during surgery. (kidney is covered by 4 layers: capsule, perirenal fat, renal fascia and pararenal fat.)
- Each gland has an outer yellow **cortex** and an inner dark brown **medulla**.



Function

Cortex

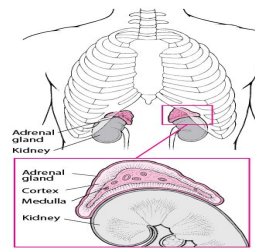
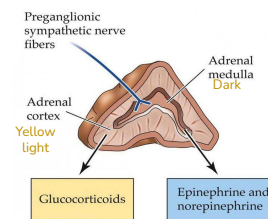
Secretes hormones including:

- **Mineralocorticoids** are concerned with control of fluid and electrolyte balance.
- **Glucocorticoids** are concerned with control of the metabolism of carbohydrates, fats and proteins.
- **sex hormones** (Small amounts) probably play a role in prepubertal development of the sex organs.

Medulla

Secretes the catecholamines:

- **Epinephrine**
- **Norepinephrine**



Left Suprarenal Gland

Right Suprarenal Gland

shape

Crescentic

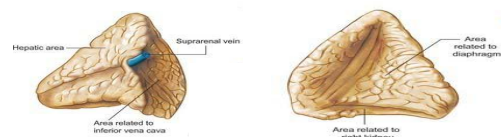
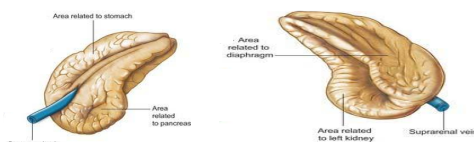
Pyramidal

Location

Extends along the medial border of the left kidney from the upper pole to the hilum (due to its crescentic shape) (L.suprarenal + upper pole) both are located in the stomach bed

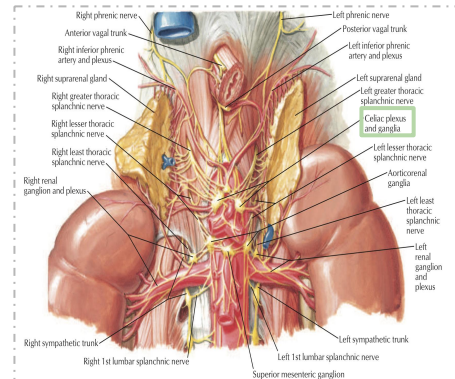
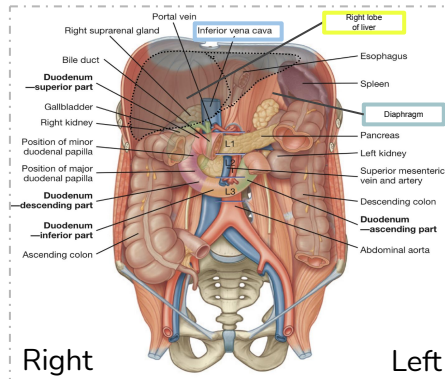
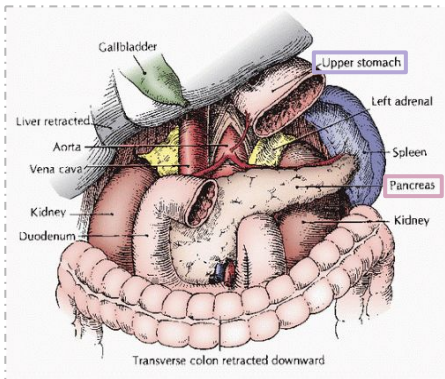
Caps the upper pole of right kidney

Pictures



Relations

	Left Suprarenal Gland	Right Suprarenal Gland
Anterior	● Pancreas ● lesser sac ● stomach	● Right lobe of liver ● IVC
Posterior	● Diaphragm	● Diaphragm
Medial	● Celiac plexus around celiac trunk and ganglia Sympathetic plexus to supply viscera	● Celiac plexus around celiac trunk and sympathetic ganglia

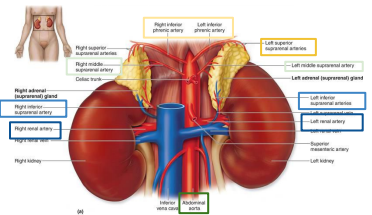


Supply of Suprarenal Glands

Arterial

They arise from: (you must memorize each artery with its origin) (موضع أسئلة)

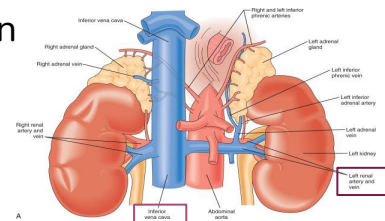
- **Inferior phrenic artery:** ● Superior suprarenal artery
- **Abdominal aorta:** ● Middle suprarenal artery
- **Renal artery:** ● Inferior suprarenal artery



Venous

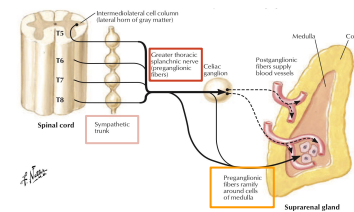
A single vein emerges from the hilum of each gland draining into:

- **Inferior Vena Cava (on right side)**
- **Left Renal Vein (on left side)**



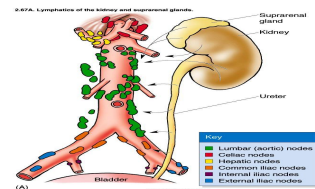
Nervous

- Preganglionic sympathetic fibers
- Derivatives of the Splanchnic nerves to supply the glands
- Most of the nerves end in the medulla of the gland.



Lymph N.

- Into **Lateral Aortic Lymph nodes**



Development of Adrenal Glands

The two parts of the adrenal gland (the cortex and the medulla) develop from two different sources.

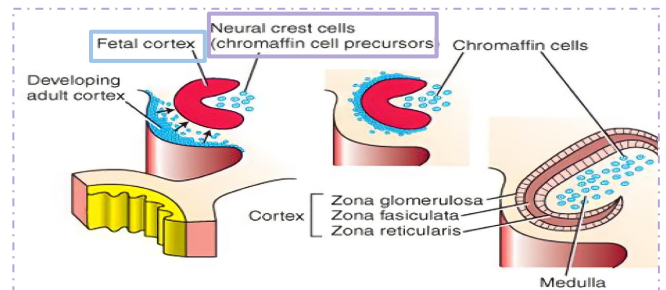
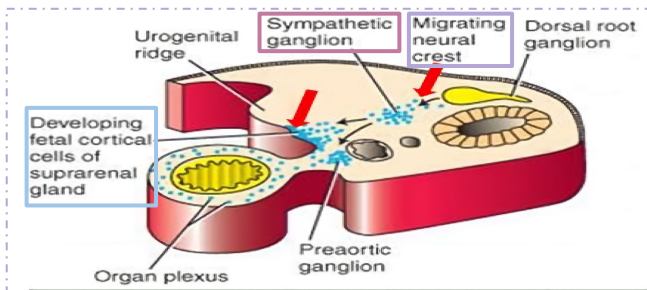
they are different from each other structural and functional according to the sources of the development.

1- Cortex

- **Mesodermal** in origin.
- Develops from the **celomic epithelium of the posterior abdominal wall**.
- It appears during the **6th week** of development (**Fetal cortex**), by aggregation of the mesenchymal cells between **dorsal mesentery** (connecting the gut with the posterior abdominal wall) and **developing gonads**.
- This fetal cortex is derived from the mesothelium lining the posterior abdominal wall.

2- Medulla

- **Ectodermal** in origin.
- Develops from the adjacent **Sympathetic ganglion**. Neural crest cells or sympathetic ganglia derived from crest cells حبيبت اقول اي واحد منهم كلهم تمشي
- Derived from migrating **Neural crest cells** (منتشأها الاساسي) cells besides neural tube which is ectodermal in origin إنما the fetal cortex mesodermal in origin
- We can find these cells migrating to : Top and sides of developing brain to form flat bone of the skull + muscles in other parts + fetal cortex of the suprarenal gland
- It forms a mass medial to the fetal cortex.

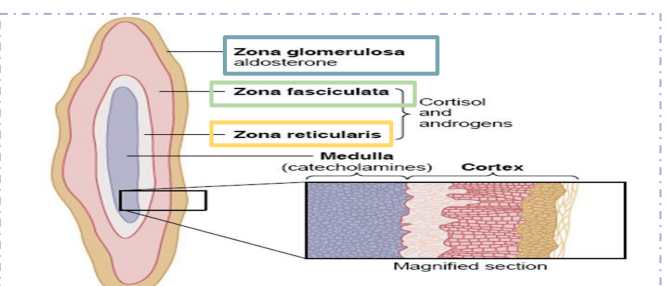
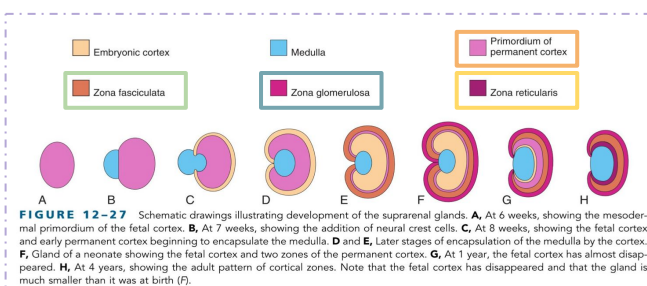


Permanent cortex

- A second wave of mesenchymal cells arise from the mesothelium, enclose the fetal cortex.
- Forms a thinner definitive **(permanent) cortex**. medulla will never change once it invade the cortex but Fetal cortex will covered by new layer of mesenchymal cells which will form permanent cortex, the primary or fetal cortex gradually degenerate

Differentiation

- Differentiation of the characteristic suprarenal cortical zones begins during the **late fetal period**.
- **Zona glomerulosa & zona fasciculata** are present at **birth**, but **zona reticularis deeper layer** is not recognizable until **the end of third year**. (so, its full development at the end of the 3rd year)



Development of Adrenal Glands

The suprarenal glands of the fetus is **10-20 times larger than** the adult glands relative to the body weight, and **are large compared** with the kidneys. This is because of the extensive size of the fetal cortex.

1

The medulla remains relatively small until after birth.

2

The suprarenal glands rapidly become smaller during the **first 2-3 weeks** after birth, due to the rapid regression of the **fetal cortex**.

3

Its involution is largely **completed in the first year of life**.

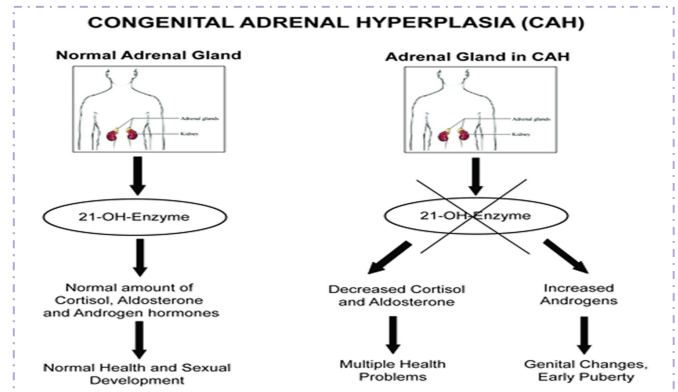
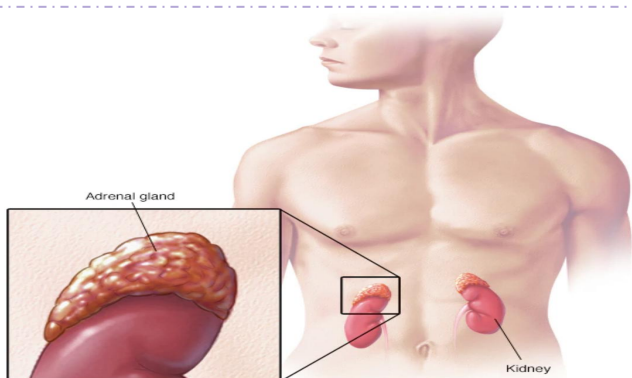
During the process of involution, the cortex is friable and **susceptible to trauma at birth** leading to severe hemorrhage.

4

Congenital Anomalies In Adrenal Cortex

Congenital adrenal hyperplasia (CAH)

- An abnormal increase in the cortical cells results in **excessive androgen** (male sex hormone) **production**; during the **fetal period**.
- In **females**, it may lead to musculation of external genitalia and enlargement of clitoris. (makes female genitalia looks like male genitalia)
- In **males**, it may remain undetected in early infancy. الولد دا يكبر بسرعة
- **Later in childhood**, in both sexes, androgen excess may lead to rapid growth and accelerated skeletal maturation. (muscles and bones getting bigger)



Anatomy's Summary

Structure	<ul style="list-style-type: none"> ○ They are yellowish retroperitoneal organs located at the upper poles of each kidney at the level of T12. ○ They are surrounded by renal fascia with kidney and separated from the kidney by perirenal fat. ○ Each gland is composed of an outer yellow cortex and an inner dark brown medulla. ○ The suprarenal gland is enclosed within the renal fascia with the kidney but in a separate compartment that allow the two organs to be separated easily during surgery.
Function	<ul style="list-style-type: none"> ○ It is a component of the hypothalamic-pituitary-suprarenal axis that is responsible for coordinating stress response and metabolism. ○ The cortex secretes hormones that include: <ul style="list-style-type: none"> → mineralocorticoids: concerned in fluid and electrolyte balance. → glucocorticoids: concerned in metabolism of carbohydrates, fats and proteins. → sex hormones: Small amounts, play a role in the prepubertal development of the sex organs. ○ The medulla secretes the catecholamines: epinephrine and norepinephrine.

Right suprarenal gland	Left suprarenal gland
<ul style="list-style-type: none"> ○ Shape: Pyramidal or triangular ○ Location: caps the upper pole of the right kidney : ○ Relations: Anterior → right lobe of the liver and IVC Posterior → diaphragm Medial → celiac plexus and ganglia 	<ul style="list-style-type: none"> ○ Shape: crescentic or semilunar ○ Location: Extends along the medial border of the left kidney from the upper pole to the hilum ○ Relations: Anterior → pancreas, stomach and lesser sac Posterior → diaphragm Medial → celiac plexus and ganglia

Arterial supply	Venous supply	Nerve supply	Lymph drainage
<p>Superior suprarenal artery Origin: Inferior phrenic artery</p> <p>Middle suprarenal artery Origin: Abdominal aorta</p> <p>Inferior suprarenal artery Origin : Renal artery</p>	<p>Inferior Vena Cava (on right side)</p> <p>Left Renal Vein (on left side)</p>	<p>Preganglionic sympathetic fibers</p> <p>Derivatives of the Splanchnic nerves to supply the glands</p>	<p>Drains Into</p> <p>Lateral Aortic Lymph nodes</p>

Origin of adrenal glands

Adrenal cortex:	Adrenal medulla:
<ul style="list-style-type: none"> ○ Is mesodermal in origin ○ Develops from coelomic epithelium from the posterior abdominal wall 	<ul style="list-style-type: none"> ○ Is ectodermal in origin ○ Develops from the neural crest cells (chromaffin cells)

Congenital disorders & development of adrenal gland

congenital adrenal hyperplasia (CAH):

- Abnormal increase in cortical cells resulting in excessive androgen production during fetal period
- In females, it may lead to muscularization of external genitalia and clitoris
- In males, it may remain undetected in early infancy
- In both sexes, later in childhood, this may lead to rapid growth an accelerated skeletal maturation

The cortex	The medulla	Permanent cortex	Differentiation
<p>During 6th week of development, mesenchymal tissue aggregate forming the fetal cortex</p> <p>The fetal cortex is derived from mesothelium tissue between the developing gonads (gonadal ridge) and the dorsal mesentery</p>	<p>Derived from the neural crest cells of the adjacent sympathetic ganglia</p> <p>it forms a mass medial to the fetal cortex</p>	<p>A second wave of mesenchymal cells arise from the mesothelium</p> <p>This encloses the fetal cortex forming a thinner permanent (definitive) cortex.</p>	<p>Differentiation begins mainly during the late fetal period the cortex differentiate into 2 zones: -Zona glomerulosa -Zona fasciculata</p> <p>These 2 zones are presented at birth while a 3rd zone appears at the end of the third year called: -Zona reticularis (is not recognizable until the end 3rd year)</p>

MCQs

Q1: Suprarenal Glands are separated from the kidneys by:

- A- Renal fascia
- B- Perirenal fat
- C- Perinephric fat
- D- A & C

Q2: At which level Suprarenal Gland sit on:

- A- T11
- B- T10
- C- T12
- D- C6

Q3: Medulla of adrenal gland is derived from:

- A- Mesoderm celomic epithelium
- B- Ectoderm
- C- Endoderm
- D- Neural crest cells

Q4: regarding left suprarenal gland which of the following is wrong:

- A- lies posterior to the lesser sac
- B- it's vein drain into the left renal vein.
- C- it is crescentic in shape.
- D- related anteriorly to inferior vena cava.

Q5: Nerve fibers that are supplying the adrenal gland are:

- A- Preganglionic sympathetic from the splanchnic
- B- Preganglionic parasympathetic from the vagus
- C- Postganglionic parasympathetic from the vagus
- D- Postganglionic sympathetic from the splanchnic

Q6: Which of the follow cannot be recognized at birth:

- A- Zona Glomerulosa
- B- Zona Reticularis
- C- Zona Fasciculata
- D- Permanent cortex

Answers: [Q1:B] [Q2:C] [Q3:D] [Q4:D] [Q5:A] [Q6:B]

SAQs

Q1: Describe the location of the adrenal gland:

-Retroperitoneal organs located at the upper poles of each kidney at the level of T12

Q2: mention the Arterial Supply and origin of each artery of the suprarenal gland:

-Superior suprarenal artery from inferior phrenic a branch from abdominal aorta
-Middle suprarenal artery from abdominal aorta
-Inferior suprarenal artery origin: renal arteries

Q3: Write the venous and lymphatics drainage of the adrenal gland:

-Veins: Right Suprarenal vein - drain into: IVC , Left suprarenal vein drain into: left renal vein
-Lymphatic: lateral aortic lymph nodes

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