EMBRYOLOGY
Team 435

Development of Adrenal (Suprarenal) Glands

Endocrine block

Objectives :

- ✓ Parts of adrenal glands and function of each part.
- ✓ Development of adrenal gland and common anomalies.

Resources :

- ✓ 435 embryology (males & females) lectures.
- ✓ BRS embryology Book.
- ✓ The Developing Human Clinically Oriented Embryology book.
- ✓ Pathoma

Color Index:

- ✓ EXTRA
- ✓ Important
- ✓ Day, Week, Month

Team leaders :

Afnan AlMalki & Helmi M AlSwerki.

Helpful video

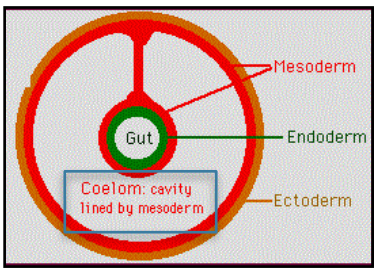
Revised by

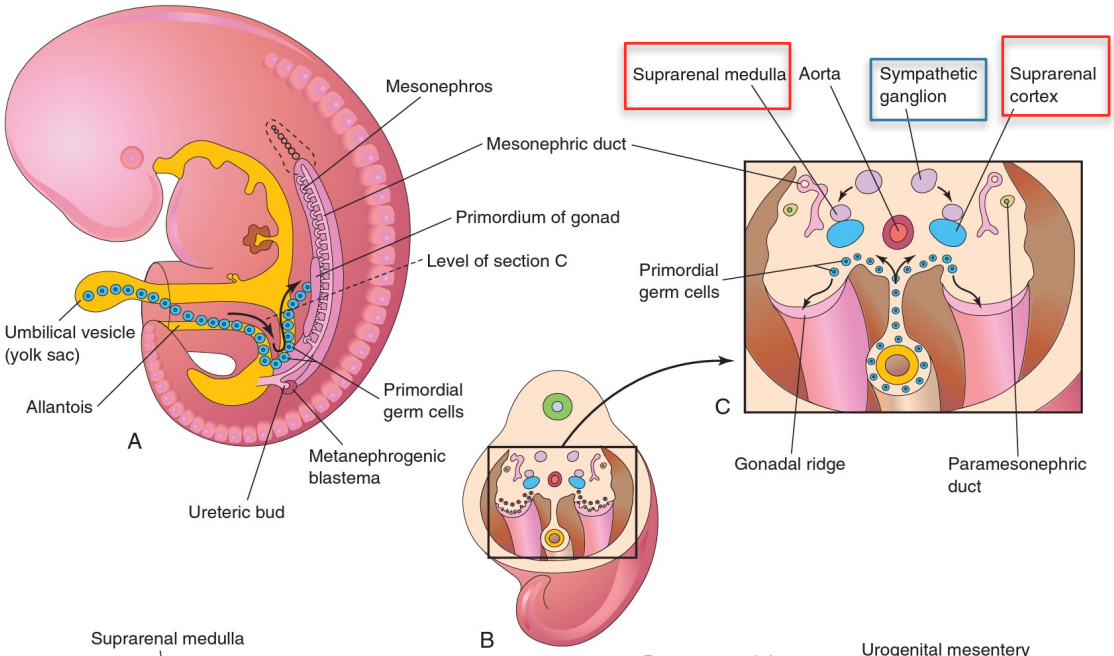
خولة العماري & هشام الغفيلي

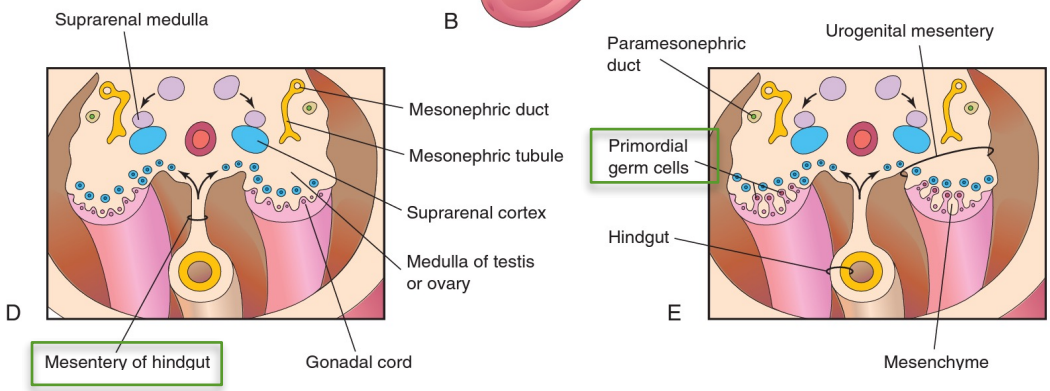
INTRODUCTION:

- The two parts of the adrenal gland develop from two different sources:

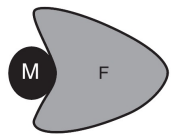
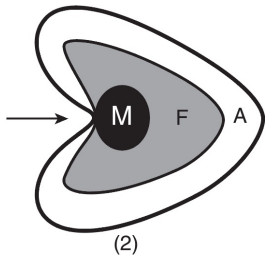
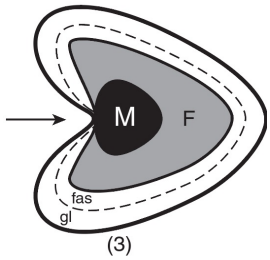
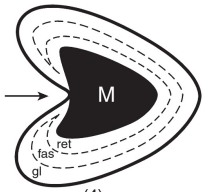
Cortex	Medulla
Mesodermal in origin	Ectodermal in origin
develops from the celomic epithelium (coelomic epithelium is a single layer of cells which covers the entire coelomic cavity including the gonadal primordium). (look pic below) of the posterior abdominal wall.	develops from the adjacent Sympathetic ganglion ,derived from Neural crest cells.
It appears during the 6th week of development, by aggregation of the mesenchymal cells between dorsal mesentery and developing gonads.	It forms a mass medial to the fetal cortex. السيمبثاتيك قانقليون جات من النيورال كريست والنيورال كريست جاء من الايكتوديرم







Development of Adrenal gland:

developmental change	Pictures
(1): At week 6, the fetal cortex (F) and medulla (M) at the medial aspect of the adrenal gland is apparent. الميدولا كانها لازقه في الكورتكس بعدين مع النمو بتدخل للداخل تذكروا البيضة و الميدولا هي صفار البيض و الكورتكس هي البياض	 (1)
(2): A second wave (2nd group) of mesenchymal cells arise from the mesothelium, enclose the fetal cortex.forms a thinner definitive adult (permanent) cortex. Note that the medulla is completely surrounded by the adult (permanent) and fetal cortex.	 (2)
(3) : Differentiation of the characteristic suprarenal cortical zones begins during the late fetal period. At birth, the fetal cortex is still present and the adult cortex has differentiated into the zona glomerulosa (gl) and zona fasciculate (fas).	 (3)
(4) : At the end of 3rd years of age, the adult cortex has further differentiated to form the zona reticularis (ret). Because of the regression of fetal cortex كانها وفرت لها مساحة للنمو	 (4)

- 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. The medulla remains relatively small until after birth. الكورتكس في الفيتس كانت كبيرة فبتصغر بعد الولادة والميدولا صغيرة في الفيتس وتكبر بعد الولادة
- The suprarenal glands rapidly become smaller during the first 2-3 weeks after birth, due to the rapid regression of the fetal cortex. Its involution(shrinkage) is largely completed in the first year of life بتبدأ الفيتال كورتكس تضمحل خلال الاسبوع الثاني او الثالث ولكن يكتمل الاضمحلال في السنة الاولى من عمره

- During the process of involution, the cortex is friable and susceptible to trauma at birth leading to severe hemorrhage. عشان كذا مو كويس الاطفال يتعرضون لاي ضربه حتى لو خفيفة على البطن.

Congenital adrenal hyperplasia (CAH):

- An abnormal increase in the cortical cells results in excessive androgen production during the fetal period. It could affect other hormones and increase the metabolic rate.
- Inherited 21-hydroxylase deficiency is the most common cause (21-hydroxylase is required for the production of aldosterone and corticosteroids > In enzyme deficiency, steroidogenesis is predominantly shunted toward sex steroid production 'which does not require 21-hydroxylase' > Deficiency of cortisol leads to increased ACTH secretion 'lack of negative feedback', which results in bilateral adrenal hyperplasia)

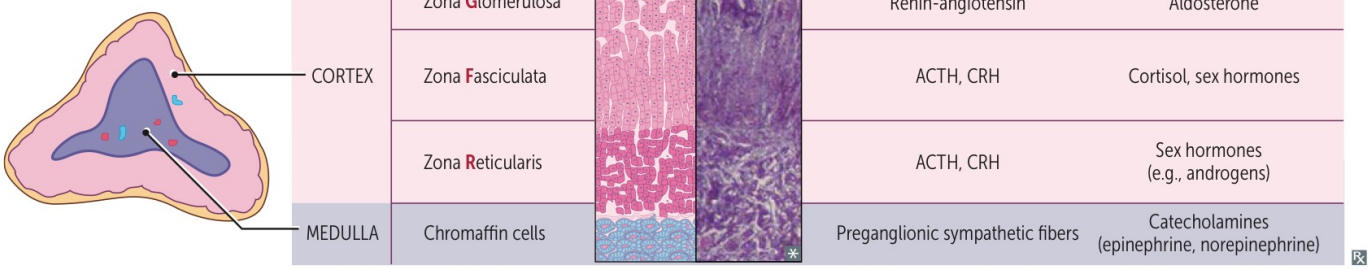
In Females	In males
- it may lead to musculization of external genitalia and enlargement of clitoris. - بسبب الحجم يخطؤون بتشخيص البنت على انها ولد	- it may remain undetected in early infancy.

- البنت يشخصونها من بدري بعد الولادة الولد يتاخر تشخيصه لسنوات لما تبدأ الأعراض
- Later in childhood, in both sexes, androgen excess may lead to rapid growth and accelerated skeletal maturation.

Extra picture

Adrenal cortex and medulla

Adrenal cortex (derived from mesoderm) and medulla (derived from neural crest).



GFR corresponds with Salt (Na^+), Sugar (glucocorticoids), and Sex (androgens).
"The deeper you go, the sweeter it gets."
Pheochromocytoma—most common tumor of the adrenal medulla in adults.
Episodic hypertension.
Neuroblastoma—most common tumor of the adrenal medulla in children.
Rarely causes hypertension.

Summary

6th Week	First appear of cortex and medulla
late fetal period.	Differentiation of the characteristic suprarenal cortical zones.
At birth	the zona glomerulosa (gl) and zona fasciculate (fas) are present
End of 3rd years	Present of zona reticularis (ret)
2-3 weak after birth	rapid regression of the fetal cortex >The suprarenal glands rapidly become smaller.
1st year of life	The Involution of fetal cortex completed

- **Congenital adrenal hyperplasia (CAH)**	
- An abnormal increase in the cortical cells results in excessive **androgen** production during the fetal period.	
In Females	**In males**
- it may lead to musculization of external genitalia and enlargement of clitoris.	- it may remain undetected in early infancy.
- Later in childhood, in both sexes, androgen excess may lead to rapid growth and accelerated skeletal maturation.	

MCQ's

1-In Congenital adrenal hyperplasia:

a. excessive androgen production
b. excessive catecholamine production
c. excessive Glucocorticoids production

2-Which one of the following is true about development of adrenal gland:

a. the cortex and the medulla develop from same origin
b. The cortex is mesodermal in origin
c. The medulla is mesodermal in origin

3- Which one of the following adrenal zones is present at the third year ?

a- Zona glomerulosa
b- Zona fasciculata
c- Zona reticularis

4- in CAH high female hormones are produced in male and vice versa, what will happen to affected persons?

a. Change in the sexual phenotype
b. Female would have penis like clitoris
c. Won't be noticeable
d. Gynecomastia in males
e. B&D

5- in adrenal cortex development 1st wave of mesenchymal cells arises from mesothelium and the 2nd from …. ?

a. Mesothelium
b. Endothelium
c. Epithelium

6- The medulla of adrenal glands develops from:

a. Mesoderm
b. Neural crest cells
c. Endoderm
d. Mesenchymal cells

ANSWERS: 1.a ,2.b ,3.c ,4.e ,5.a ,6.b