Embryology
/organogenesis/

Week 4: 06. 04 – 10. 04. 2009
Development and teratology of reproductive system.
Repetition: blood and hematopoiesis.
19. Indifferent stage in development of reproductive system.
22. Development of external genital organs.
23. Developmental malformations of urogenital system.
Male or female sex is determined by spermatozoon Y in the moment of fertilization.
SRY gene, on the short arm of the Y chromosome, initiates **male** sexual differentiation.

- The SRY influences the undifferentiated gonad to form testes, which produce the hormones supporting development of male reproductive organs.

- Developed testes produce testosterone (T) and **anti-Mullerian hormone (AMH)**.

- Testosterone stimulates the Wolffian ducts development (epididymis and deferent ducts).

- AMH suppresses the Mullerian ducts development (fallopian tubes, uterus, and upper vagina).
- Indifferent stage – until the 7th week
- Different stage

- Development of gonads
- Development of reproductive passages
- Development of external genitalia
Development of gonads

Dorsal wall of body: **urogenital ridge**

**mesonephric ridge** (laterally)

**genital ridge** (medially), consisting of **mesenchyme** and **coelomic epithelium**
Three sources of gonad development:
1 – condensed **mesenchyme** of gonadal ridges (plica genitalis)
2 – **coelomic epithelium** (mesodermal origin)
3 – **gonocytes** (primordial cells)
Primordial germ cells – gonocytes – appear among endoderm in the dorsal wall of the yolk sac. Gonocytes migrate along the dorsal mesentery of the hindgut into the gonadal ridges and induce (!) gonad development.
Indifferent gonad development

- **Gonocytes** penetrate coelomic epithelium and mesenchyme

Together with **gonocytes**, also **cells of coelomic epithelium** penetrate **mesenchyma**:

**primary (primitive) sex cords**

of indifferent gonad
Primary proliferation
Secondary proliferation

INDIFFERENT GONAD

Tunica albuginea

TESTIS

primary sex cords = medullary cords

OVARY

secondary sex cords = cortical cords

ONLY in ovary
**TESTIS:**

Primary sex cords $\Rightarrow$ tubuli semuniferi contorti

Gonocytes $\Rightarrow$ spermatogonia
Coelomic cells $\Rightarrow$ Sertoli cells
Mesenchyme $\Rightarrow$ Leydig cells, interstitial connective tissue

**OVARY:**

Primary sex cords $\Rightarrow$ degenerate in ovarian medulla

Secondary sex cords $\Rightarrow$ disintegrate into the follicles:
Gonocytes $\Rightarrow$ oogonia
Coelomic cells $\Rightarrow$ follicular cells
Mesenchyme $\Rightarrow$ ovarian stroma
Development of reproductive passages
(indifferent – differentiated stage)

• Plica urogenitalis (urogenital ridge) – 2 ducts:
  Ductus mesonephricus (Wolffii)
  Ductus paramesonephricus (Mülleri)
Indifferent stage:

Wolffian duct

Müllerian duct
Differentiated stage of development:

**Müllerian duct:**
- Oviduct
- Uterus
- Cranial part of vagina

**Wolffian duct:**
- Ductus epididymidis
- Ductus deferens
- Ductus ejaculatorius

Ductuli efferentes in epididymis and rete testis originate from mesonephric tubules (see mesonephros)
Degenerating excretory tubules of the mesonephros

Rete testis

Testis cords

Tunica albuginea

Mesonephric duct

Paramesonephric duct

Degenerating medullary cords

Cortical cords of the ovary

Mesonephros

Paroophoron

Epoophoron

Gartner's duct

+ Rudimentary Structures
Development of external genatalia
(indifferent – differentiated stage)

Genital tubercle
[tuberculum genitale]

Urethral (cloacal) folds
[plicae genitales]

Labio-scrotal swellings
[tori genitales]
Seminal vesicles – develop as diverticles of ductus deferens (from Wolffian duct)

Prostate – develops as numerous diverticles off urethra (from pelvic part of sinus urogenitalis)
Position of gonads during development

- Gonad develops in only short, **lumbal** part of genital (gonadal) ridge *(Th6 – S2)*
- Cranial part - disappears
- Caudal part transforms into *gubernaculum*

- **Testes** – descensus into the scrotum
- **Ovaries** – change also their position due to fusion of Müllarian ducts and formation of broad ligament
Testis – descends into the scrotum
Ovaries – change their position due to fusion of Müllerian ducts and formation of broad ligament
Congenital malformations - 1

- Genetic anomalies:
- Gonad(s) agenesis
- Hermafroditism (ovotestes, ovary+testis) + chromosomal aberations (45X/46XX, 45X/46XY, 47XXY/46X, etc.)
- Pseudohermafroditism – karyotype and gonads do not correspond to external genitalia
- Gonadal hypoplasia – Turner sy. (45X0), Klinefelter sy. (47XXY)
Congenital malformations - 2

- Kryptorchism
- Hydrocele testis
- Hypospadias, epispadias
- Developmental defect of uterus (and vagina)
  uterus et vagina separatus, uterus bicornis, uterus septus or subseptus, uterus unicornis etc.
Repetition of blood

• Composition of the blood
• Hematocrit
• Hemoglobin
• Erythrocytes – shape, size, density per 1 μl
• Reticulocytes
• Anisocytosis
• Poikilocytosis
• Polycythemia (= polyglobulzia)
• Granulocytes
• Agranulocytes
• Number of leukocytes per 1μl
• Anemia
• Leukocytopenia
• Thrombocyte
• Number of thrombocytes per 1μl
• Hyalomere, granulomere
• Bone marrow structure
• Erythropoiesis
• Granulocytopenesis
• Megakaryocyte
• Endomitosis

• Differential white cell count (DWCC) !!!
• Shift to the left or to the right
Neutrophilic granulocytes: 10-12 μm in Ø

„band“
4 % in DWCC

„segment“
67 % in DWCC
Basophilic granulocyte: 8 µm in Ø, only 1 % in DWCC
Eosinophilic granulocyte: up to 14 μm in Ø, 3 % in DWCC
Lymphocyte

20% in DWCC

Monocyte

5% in DWCC
A: Genital tubercle, Genital swelling, Cloacal membrane, Cloacal fold

B: Genital tubercle, Urethral folds, Anal fold

A: Phallus, Urethral plate, Urethral groove, Urethral fold, Scrotal swellings, Perineum, Anal folds

B: Lumen of penile urethra

C: Solid epithelial cord, Glandular part of urethra

D: Urethral outlet, Glans penis, Line of fusion of urethral folds, Line of fusion of scrotal swellings (scrotal septum), Perineum, Anus