DEVELOPMENT AND FUNCTIONAL ANATOMY of the UROGENITAL APPARATUS
Urogenital System (apparatus urogenitalis):

- urinary organs (organa uropoetica)
- the genitals (organa genitalia).
The urinary system consists of

- 2 kidney
- 2 ureter
- Urinary bladder
- Urethra
kidney function

- Filtration of blood plasma
- Regulation of blood volume and blood pressure
- Production of renin
- Production of erythropoietin
- Regulation of acid-base balance
- Participation in vitamin D metabolism
Topography of kidney
Topography of kidney

Fixing apparatus of kidney

- intra-abdominal pressure
- renal bed
- Renal crus
- Kidney coats
renal bed
kidney fascia
Supportive Tissue

- Fibrous capsule
Supportive Tissue

- Perirenal fat capsule
Supportive Tissue

- Renal fascia
Renal crus
The internal structure of kidney
Segments of kidney

A. renalis

Vv. renales

Ureter

Segmentum superius

Segmentum inferius

Segmentum anterius superius

Segmentum anterius inferius

Segmentum posterius

Нижний передний сегмент

Почечная артерия

Почечные вены

Мочеточник
The internal structure of kidney
Корковая долька, lobulus corticalis - состоит из мозгового луча (лучистой части коркового вещества), окруженного лабиринтами коры (свернутой частью), и ограничена междольковыми артериями и венами.
kidney blood supply

- Cortical radiate vein
- Cortical radiate artery
- Arcuate vein
- Arcuate artery
- Interlobar vein
- Interlobar artery
- Segmental arteries
- Renal column
- Papilla of pyramid
- Cortex
- Minor calyx
- Renal pyramid of medulla
- Fibrous capsule
- Renal artery
- Renal vein
- Renal pelvis
- Major calyx
- Ureter
kidney blood supply
Structure of nephron
Peculiarities of the blood supply of the kidneys

- Arterial "miracle" kidney network
- The secondary capillary network
The formation of urine includes:

- Filtration in the body of the nephron
- Reabsorption in the tubules of the nephron (regulated by ADH)
Microscopic structure of kidney

- **Juxtaglomerular apparatus** - is involved in the regulation of blood pressure, juxtaglomerular cells produce renin
- Located close to the glomerulus, in the wall of the afferent and efferent arterioles at the endothelium,
- is involved in the regulation of blood flow and urine formation in the kidneys,
- it affects the overall hemodynamics and water-salt metabolism.
- Secrete renin, which catalyzes the formation of the angiotensin, aldosterone in the adrenal glands and antidiuretic hormone in the hypothalamus.
- Is composed of three main parts - *macula densa, juxtaglomerular and juxtavascular cells*).
- **Macula densa** - part of the wall of the ascending part of the loop of the nephron, cells are chemoreceptors.
Juxtamedullary nephrons (10-15%),
- their glomeruli are located at the border of the cortex and medulla kidney,
- efferent arterioles are wider than afferent,
- loops of Henle are the longest and descend almost to the top of the papilla of the pyramids.
- Efferent arterioles form a straight descending and ascending capillary vessels, reaching deep medulla parallel loops of Henle.

Juxtamedullary nephrons play a leading role in the processes of concentration and dilution of urine.
Blood Vessels in Parenchyma of Kidney: Schema

- Afferent glomerular arteriole
- Efferent glomerular arteriole
- Juxtaglomerular apparatus (renal artery and renal vein)
- Fibrous capsule
- Renal cortex
- Renal medulla (pyramids)
- Cortical glomerulus
- Cortical capillary plexus
- Corticomedullary glomerulus
- Juxtaglomerular apparatus (renal artery and renal vein)
- Renal vein

KIDNEYS AND SUPRARENAL GLANDS
PLATE 326
renal pelvis and kidney cups

Pelvis renalis

Calices renalis majores

Calices renalis minores
Kidney Development Stages

- Pronephros (head kidney) **pronephros** - 3rd week
- Primary kidney (trunk) **mesonephros** - 4-8 weeks
- Final kidney (pelvic) **metanephros**
development of kidney
development of kidney

(a) Week 5

(b) Week 6

Degenerating pronephros
Urogenital ridge
Mesonephros
Mesonephric duct (initially, pronephric duct)
Hindgut

Developing digestive tract
Yolk sac
Allantois
Cloaca
Ureteric bud

Degenerating pronephros
Duct to yolk sac
Allantois
Body stalk
Urogenital sinus
Rectum
Ureteric bud
Metanephros
Branching of the ureteral outgrowth of mezonefral duct - forming urinary tract
metanephros

of TISSUE of mesonephric duct
- Collecting ducts
- Papillary ducts
- Renal calices
- Pelvis
- Ureter

OF METANENFRI TISSUE
- Capsule of renal corpuscles
- Loop of Henle
- Convoluted departments of tubules
CLASSIFICATION OF KIDNEY ANOMALIES

- 1. SHAPE anomaly
- 2. POSITION anomaly
- 3. NUMBER anomaly
- 4. COMBINED anomaly
SHAPE anomaly

Figure 15-15 Stages in the formation of a horseshoe kidney. A to C, As the kidneys migrate out of the pelvis, their caudal poles touch and fuse. D, Pelvic kidney in an adult. Note the lack of rotation of the kidneys so that the ureters face ventrally instead of medially. E, Horseshoe kidney. (E, Photo 914E from the Arey-DaPeña Pediatric Pathology Photographic Collection, Human Developmental Anatomy Center, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC.)
Anomalies of the urinary system

- kidney aplasia
- kidney hypoplasia
- Ectopic kidney
- horseshoe kidney
- S-shaped kidney
- Additional renal arteries
- The doubling of the urinary tract (renal pelvis, ureter)
- Congenital polycystic kidney disease
- Lobed (Bear) kidney
- Bladder exstrophy
Figure 15-12 Common renal anomalies. A, Unilateral renal agenesis. The ureter is also missing. B, Unilateral renal hypoplasia. C, Supernumerary kidney. D and E, Complete duplication of ureter, presumably arising from two separate ureteric buds. F and G, Partial duplication of ureter, presumably arising from a bifurcated ureteric bud.
Figure 15-14 Migration defects of the kidney. A, Pelvic kidney. B, Crossed ectopia. The right kidney has crossed the left ureter and has migrated only part of the normal distance.
newborn kidney
The bladder develops from

- Urogenital sinus,
- the surrounding mesenchyme of allantois and
- caudal parts of mezonephral ducts.
the bladder and the peritoneum
the ratio of the bladder to the peritoneum
Bladder extrophy
Bladder exstrophy
The topography and structure of the uterus
The topography of the uterus and its ligaments
Fixing uterine apparatus

Figure 5.27. Parts of the broad ligament of the uterus.

Figure 5.28. Ligaments of the endopelvic fascia that support the uterus.
A. Normal positions

Anteflexed

Anteverted

B. Retroflexed

C. Retroverted

D. Prolapsed

E. Supporting structures of the uterus, superior view

F. Supporting structures of the uterus, lateral view
The topography of the small pelvis
Mail genitals
Shell of the spermatic cord and the testicle

Figure 4.16. Contributions of the anterior abdominal wall to the coverings of the spermatic cord and testis.
development of internal male genital organs
development of internal male genital organs
development of internal male genital organs
Urogenital derivatives
Embryology: Urogenital Derivatives
abnormalities of the uterus
Derivatives of mesonephric duct

**men**
- the epididymal duct
  – deferens duct
- ejaculatory duct
- the seminal vesicles

**Women**
- epoophoron
- paroophoron
Anomalies of development of male sex organs

- hydrocele testis
- Hydrocele of the spermatic cord
- Cryptorchism (3%) unilateral and bilateral
- Ectopic testis
- Hypospadias
- epispadias
Anomalies of the testes

**Anomalies of number:**
- Monorchism - absence of one testicle
- Anorchia - absence of both testes
- Poliorchizm - the presence of three or more testes

**Anomalies of the structure:**
- Hypoplasia of one or both testicles

**Anomalies of position:**
- Cryptorchism – delay descent of testes (abdominal and inguinal)
- Ectopic testis - Testicular deflection on the way into the scrotum after leaving of the inguinal canal (under the thigh skin, inguinal region, perineum, the opposite side of the scrotum)
- Hydrocele – no obliteration of processus vaginalis of the peritoneum
Ectopic testis
Anomalies of the external male genitals

• Hypospadias - no back wall of the urethra in its distal parts.
• Epispadias - the splitting of the front wall of the urethra.
Hypospadias and epispidias