LESSON
ON THE THEME:
"MORPHOFUNCTIONAL PECULIARITIES OF RENO-URINARY SYSTEM IN CHILDREN. SEMEYOLOGY OF AFFECTIONS. MAJOR SYNDROMES IN NEPHROLOGY. "

DEPARTMENT OF PEDIATRICS

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1. **Embryonic development.**

Provenence –intermediary mezoblast 3 successive stages:

- pronephros from 3**week**
- mezonephros from **4 week**
- metanephros **4–32 week**.

Nephrogenesis ends at 36 week of gestation.
At 9 week the kidneys begin to function, they are upper from bifurcation of aorta.

2. **Normal anatomy of kidney**
   - pair organ
   - retroperitoneal position
   - situated in lombar zone, paravertebrally
   - oblique position from up to down and from inside to outside
   - form de of bean

Topography
- NB: inferior pole under crista iliaca
- 1year: inferior pole at crista iliaca
- 2 yrs: inferior pole above crista iliaca
- big child–adult: T 11 -T12 and L1 –L2.

Dimensions of kidney
newborn = 4 -4,5 x 2,3-2,7 cm
< 5 yrs = 8,5 x4,3 cm
5-7 yrs = 9,5 x 4,3 cm
8-11 yrs = 11,2 x 5,3 cm
12 -15 yrs = 12,6 x 6-7,5 cm

Weight
- NB =11--12g= 1/100 from weight
- 1 yr = 36--37 g =1/269 from weight
- 15 yrs = 105--120 g = 1/320 from weight

Renal pelvis
• in children <yr not exceeds 5 mm.
• in children over 1 yr not exceeds 8 mm (pyelectasia)

Urethers
- New-born = 5--7 cm, sinuous line
- 2 ani = doubling at10--14 cm
- adult = 27-30 cm

Urinary bladder:pelvian abdominal organ
- NB = 80 ml
- 1 yr = 100 ml
- 2 yrs =140 ml
- 3 yrs =160 ml
- adult = 300--400 ml

ANATOMICAL PECULIARITIES OF RENAL SYSTEM IN CHILDREN
- relatively big dimensions and weight
- topographically the kidney are disposed lower down (palpable)

- increased mobility of kidneys
- the kidney has lobular structure until 2-3 yrs, cortical layer is undeveloped
- urethers are long and with many physiological flexions
- renal and intestinal lymph vessels communicate, there is a factor of pathogen flora translocation (intestine-kidneys)
- thin renal capsula
- urethra in girls is short, large
- Urinary bladder disposed more upper, palpable

Principal functions of kidneys

1. Maintaining of internal medium homeostasis
2. Elimination of metabolism final products
3. Endocrine function (incretory)
4. Regulation of blood pressure
5. Metabolic function (glyconeogenesis)
6. Forming, deposition and elimination of urine.

Peculiarities of renal function in children

- Glomerular filtrate reduced until 2 years
- Reabsorbtion of glucose, aminoacids, phosphates is reduced (physiologic glucosuria)
- Reduced capacity of water, electrolytes, and H+ ionis tubular transport
- Reduced excretion of Na from diet (tendency of Na, not salt, retention until 2 years)
- Reduced water manipulation at tubular level (tendency to hydric retention in case of overloading and to dehydration in case of deficitar hydric intake)
- Regulation of acido-basic equilibrium in immature baby: decreased renal threshold for bicarbonates (excessive excretion of bicarbonate with retention of H+), especially in prematures (cause of frequent metabolic acidosis)
- Reduced capacity of urine concentration, especially in prematures, definitive maturation at 9-12 years
- Immaturity of renal functions regulation mechanisms (nervous, hormonal).

Semeiology of urinary system affections

1. **Anamnesis:**

Age

NB: -external malformations of reno-urinary system:

- Imperforation of urethra, epispadia, hypospadia, fimoses

Infants:

- hereditary tubulopathies
- reno-urinary malformations, including VUR
- renourinary tract infection
- nephroblastoma (WILMS tumor)
- nephrotic syndrome

Children- Adolescents:

- renourinary tract infection, including specific

- poststreptococcal acute GN
- chronic renal diseases
- Precocious manifestations of polycystic kidney
- **Heredo-collateral antecedents:**
- Familial predisposition, deafness, AHT
- Renal malformations
- Polycystic kidney
- Renal lithiasis
- **Personal pathologic antecedents**
- Evolution of pregnancy and delivery
- Infections with diverse localization, duration, etiology
- Cardio-vascular diseases, inclusively essential or secondary AHT
- Digestive tract diseases
- Metabolic diseases with renal involvement:diabetes,hypercalcemia.
- Collagenoses with renal involvement through vasculites (SLE, PN)
- Medicaments

General symptoms in reno-urinary diseases

- Abdominal, lombar pain
- High fever, or groundless subfebrility
- Peripheral renal edemas
- AHT, inexplicable headache
- Disorders of voiding, modified aspect of urine
- Dispeptic groundless disorders
- Frequently ill child
- Deafness, groundless disorders of sight
- Weakness, weight loss
- Pallor, anemia resistant to iron therapy

Physical objective examination

Signs of reno-urinary affection

- Physical development- staturoponderal
- retardation
- Stigmas of disembryogenesis
- Genital external anomalies
- Peripheral edemas, ascitis, AHT
- Marked pallor-peripheral systemic vasoconstriction, anemia
- palpable kidney, suprapubian bladder, asymmetric abdomen
- Abdominal pain in flancs, suprapubian at palpation
- Forced geno-cubital position
- Disorders during voiding
- Signs of systemic diseases (SLE, vasculites...).

Clinical examination of urinary tract

Inspection:

Lombar region:

-localized bulging: renal tumors, perirenal hematoma

-erythema and edema: perirenal phlegmon.

Hypogastric region: bulging in the case of vesical globe.

Palpation of kidneys:

- it is made in dorsal decubit, lateral decubit and orthostatism;
- kidney are not, normally, accessible to palpation
- the right kidney can be palpated in child under 2 years
- become palpable in case of abnormal mobility, ptosis or
- volume increasing
- bimanual palpation in dorsal decubit (Guyon method):

Giordano-Pasternatzki manoeuvre

(bilateral lombar, symmetric percussion): Percussion of lombar region, with the fingers tips or with hand cubital margin Provokes pain in renal affections by renal lithiasis type, acute glomerulonephritis and pyelonephritis, renal abscess or renal infarction, (sometime very strong pains).

Major renourinary signs and symptoms

1. Abdominal pain

Abdominal reno-urinary pain: Uni- or bilateral lombar pain, Abdominal in flancs, Hypogastric-suprapubian, Pelviperineal.Acute or chronic. Permanent or colicative character

Mechanisms of lombar renal pain:distension of renal capsule; vascular peripheral obstruction; distension of excretory pathways**;** contracture of urethers smooth musculature

2. Disorders of diureses

Normal diuresis represents the urine quantity eliminated in one interval of time(normal values: 800-2000 ml/day, 0,5-1,5 ml/min), in function of liquid intake and loss. At 1 year = 600 ml.

In child **V = 600 + 100 (n - 1)** or **V = 100 x (n + 5)**

Disorders of diuresis are: polyuria, oliguria, anuria, nicturia (nocturia), opsiuria.

3. ***Disorders of voiding***

The voiding is an reflex act, released, in normal mode, only in the wakeful state. Normal voiding is spontaneous, voluntary, immediate, painless, with abundant and regulated jet, complete (an residuum>25ml is non significant).

Frequency of voiding: 0-6 months20-30, 6-12 months10-15, 2-3 yrs 8-10, big child 6-7/day.

Disorders of voiding can be determined by: *obstacles* in normal elimination of urine; *sensitivo-motory asynchronism* of bladder musculature, due to some congenital or acquired affections.

The disorders of voiding are: pollakiuria, rare voiding, dysuria, painful voiding, retention of urine, incontinence of urine and impressive voiding.

4. ***Syndrome of renal edema***

Presence of localized or generalized peripheral edema.

Syndrome of renal edema - peculiarities: white, soft, fluffy, painless, let persistent bucket

appear initially in morning on face, eyelids, periorbitally, sacral region, on shanks, abdominal wall. Are declive- easily change position in connection with changing of child's bed position.

Can involve serous tunics(peritoneum,pleura, pericardium, scrotum) achieving until anasarca (nephrotic syndr.). Covering skin is transparent, shiny, thin, has waxy aspect.

5. ***Arterial hypertension syndrome in renal affections***

Arterial pressure is directly proportional with cardiac debit and vascular peripheral resistance. Hypertensive syndrome in children with reno-urinary diseases is due to both mechanisms: Hypervolemia (water, sodium retention).Activation of SRAA. Increasing of depressor substances forming(prostaglandins, kalicreins, medullary lipids). Vegetative dysfunction with marked hypersympaticotonia.

Causes of arterial hypertension (AHT) in children are:

- reno-vascular: stenosis of renal arteries, thrombois of renal veins and arteries, aneurismas of renal artery.
- reno-parenchimatous: glomerulonephritis, chronic pyelonephritis, polycystic kidney, congenital anomalies of kidneys, nephroblastoma

Acute nephritic syndrome

Renal signs:

- Macrohematuria
- Oliguria
- Moderate proteinuria
- Cylindruria- hialinic, hematic

Extrarenal signs:

- Minor-moderate edemas
- AHT
- Azotemia

Nephrotic syndrome

- Proteinuria >3,0-3,5 g/l
- Hypoalbuminemia
- Generalized edemas
- Hyperlipidemia, lipiduria

Acute renal failure (ARF) is an acute complex clinico-biologic syndrome, resulted from brutal, but in general reversible, alteration of renal functions of internal medium homeostasis maintaining.

Clinical picture.

Signs of causal disease: shock, infection, hemorrhage, intoxications, hemolysis, burns, preexistent renal disease.

Oligoanuria

Azotemia (increased levels of urea, creatinin)

Metabolic acidosis

Hydrosaline retention: edema, hyperpotassemia, hyponatremia, hypocalcemia

Chronic renal failure is a nonspecific syndrome with slow progressive and definitive lesion of nephrons, and irreversible losing of functions of internal homeostasis maintaining.

Actual term is *Chronic renal disease(CRD).*

Frequent causes of CRF:

- malformative uropathies (obstructive, kidney hypoplasia)
- Hereditary nephropathies
- Glomerular nephropathies
- Vascular nephropathies, in systemic diseases
- Renal polycystosis

Unknown causes

Complementary examinations in renal diseases

1. Examination of urine

- **macroscopic**
- Physico - chemical
- microscopic
- bacteriologic

2. **Exploration of renal function**

- Capacitaty of renal dilution and concentration: simple urinary density. Fractioned density (Zimnitzki probe)
- Biochemical blood examination.
- Imagistic reno-urinary explorations:

1. Renal-vesical echography;
2. Simple radiography;
3. Retrograd urethrocystography;
4. Endovenous excretory urography;
5. Renal scintigraphy;
6. Renal computerised tomography;
7. Angiografia with digital substraction;
8. **Cystoscopy;**
9. **Puncture - renal biopsy.**

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Nephrotic syndrome

- Proteinuria >3,0-3,5 g/l
- Hypoalbuminemia
- Generalized edemas
- Hyperlipidemia, lipiduria
- More frequently the NS is in 3-9 years children, boys,
- diverse causes

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- Unknown causes