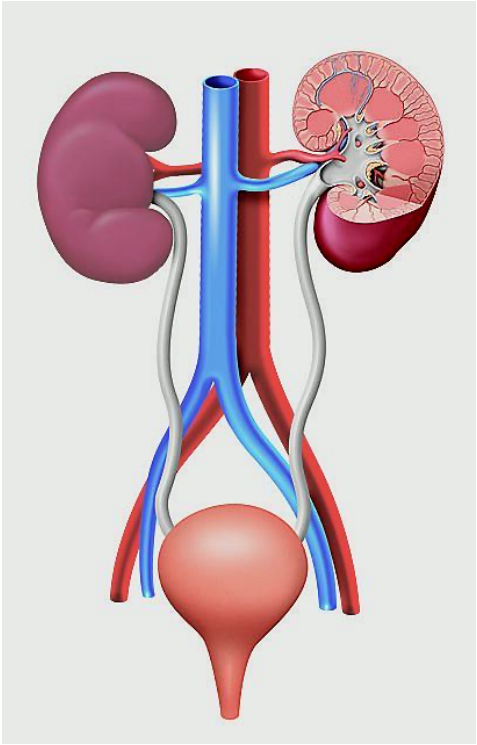
Basic symptoms of the urinary tract diseases and their differentiation



Klinika Pediatrii z Oddziałem Obserwacyjnym WUM

How to make a correct diagnosis?

- Medical history (!)
- Physical examination
- Additional tests (including laboratory tests)

Medical history in the urinary tract diseases

Detailed paediatric history taking, you should pay attention to:

- Present complaints – the course of illness, character, severity
- The course of the fetal period and the perinatal period – a prenatal ultrasound
- Past history- child's ilnesses in the past, icluding urinary tract infection in the medical history and diagnosed urinary tract defects
- Family history
- Micturition disorder(urinary incontinence,often or rare micturition, urinary urgency)
- Constipation, faecal incontinence

Physical examination

- Blood pressure measurement
- Presence of oedema
- Kidneys palpation
- Goldflam’s sign
- Bladder (Emptied bladder is physiologically impalpable)

External genitourinary organs

- Assessment:
  - of the type of genitourinary organs
  - compability of their development according to the child's age

In boys	In girls
Size of the penis	Development of the labia
Presence of the phimosis	Vulvar mucosa,presence and type of the mucus in vulval vestibule
Site of the urinary meatus	Urinary meatus/urethra
Presence of a leakage around the catheter, its amount and character	
Appearance of the scrotum	
Presence of the testicles in the scrotum, their size,symmetry density and tenderness	

Additional tests

- **Evaluation of renal functions:**

- Urinalysis
- Creatinine
- Urea
- GFR assessment(flow rate of filtered fluid through the kidney)

Urinalysis

Clarity	clear ((transparent))
Colour	yellow ((transparent yellow, yellow))
Glucose	negative ((negative)) [mg/dl]
Bilirubin	negative ((negative))
Ketone bodies	negative ((negative)) [mg/dl]
Specific gravity	1.025 (1.002-1.035)
pH	6.0 (5.0-7.5)
Protein	negative ((negative)) [mg/dl]
Urobilinogen	1.0 (0.2-1.0) [E.U./dL]
Nitrite	negative ((negative))
Blood	negative ((negative))
Leukocyte esterase	negative ((negative))

Urine microscopy

SQUAMOUS EPITHELIAL CELLS: singular in the sample

WHITE BLOOD CELLS: singular in the sample

RED BLOOD CELLS : singular in the sample

Normal result of the urinalysis

Urinalysis

- **Clarity** – urine is normally clear. Turbid urine can appear in e.g. erythrocyturia, bacteriuria, haemoglobinuria, when phosphates and urates are present in the urine.
- **Colour** – normally urine is straw-yellow.
- - yellow: bilirubin, urobilinogen
- - brown/syrup ale: hemoglobinuria, mioglobinuria
- - reddish: erythrocyturia, medication (nitrofurantoin, metronidazole), urates present in the urine (bricky colour)
- - green/blue: medication, Pseudomonas aeruginosa infection

Urinalysis

pH – normal 5,0-7,5

PH level>7,5 (alkaline)

- with urinary continence

- infection of the urinary tract caused by bacteria that produce urease (Proteus, Pseudomonas)

- metabolic or respiratory alkalosis

PH level < 5,0 (acidic)

-respiratory or metabolic acidosis

- high fever

Urinalysis

Specific gravity –normal range: 1,002-1,035

Children to the age of 2 do not concentrate the urine effectively that is why the specific gravity can be low (physiology). Low specific gravity: renal failure. High specific gravity: dehydration.

Glucose in the urine -normally it is absent. Glycosuria can occur in:

- diabetes
- tubulopathies

Ketone bodies – normally they are absent. They can appear as a result of:

- starvation
- dehydration
- diabetic ketoacidosis

Urinalysis

Protein – normally it is absent
Proteinuria **–** eliminating protein with the urine > 150 mg/day

When can protein be present in the urine and we do not conclude an illness?

- Little amount of urine
- Physical exercise
- Fever
- Orthostatic proteinuria

Proteinuria appears in i.a.:

- nephrotic syndrome
- Ifection of the urinary tract
- glomerulonephritis

Hematuria

> 5 erythrocytes in the urine sediment at a magnification of 400x

Division of erythrocyturia:

- microscopic – erythrocytes visible only under the microscope
- macroscopic – change of the colour of the urine(1 ml of blood in 1 litre of urine is enough to change the colour)

Erythrocyturia can appear in:

- urolithiasis
- cystitis
- glomerulonephritis

Creatinine Clearance

One of the markers of renal failure is creatinine. In children, based on creatinine we calculate a creatinine clearance . It is a parameter that estimates Glomerular Filtration Rate(GFR).

<u>Schwartz's formula for Creatinine Clearance</u>

eGFR [ml/min/1,73 m^2] = 0,413 x height [cm]/SCr [mg/dl]

SCr – serum creatinine

Remember, there isn't a fixed norm for a creatinine level in children. Always calculate the clearance.

Cases

Below you can find some descriptions of the most common cases of the urinary tract diseases in paediatrics.

Please read the description of the case, think which tests should be made, what aberrations do we expect to find, what abnormalities do we declare and familiarise yourself with the likely diagnosis.

1

A mother came to a paediatrician with a 5-year-old boy because of the child's malaise and a loss of appetite that has lasted for 3 days . She states that two weeks ago the child had an inflammation of the throat, but after few days of being ill, he returned to his normal activities. That is why she is concerned if the child has got an infection again. Additionally she has noticed that the child's urine has a brownish colour(of a coke) From the abnormalities in the physical examination the doctor has determined a trace of swelling in the lower leg. Parameters checked during the visit:

BP: 120/80 mm Hg

HR: 100/min

Body temperature: 37,8°C .

Which test should be made? Are the checked parameters within the normal range?

Clarity	clear ((transparent))
Colour	brownish ((transparent yellow, yellow))
Glucose	negative ((negative)) [mg/dl]
Bilirubin	negative ((negative))
Ketone bodies	trace ((negative)) [mg/dl]
Specific gravity	1.025 (1.002-1.035)
pH level	6.0 (5.0-7.5)
Protein	44 ((negative)) [mg/dl]
Urobilinogen	1.0 (0.2-1.0) [E.U./dL]
Nitrite	negative ((negative))
Blood	many ((negative))
Leukocyte esterase	negative ((negative))

Urine microscopy

SQUAMOUS EPITHELIAL CELLS:	singular in sight
WHITE BLOOD CELLS:	from 2 to 3 in sight
ISOMORPHIC AND DYSMORPHIC ERYTHROCYTES:	from 60 to 70 in sight
PRESENT:	singular bacteria
PRESENT:	red blood cells casts and hyaline cast

Clarity	clear ((transparent))
Colour	**brownish** ((transparent yellow, yellow))
Glucose	negative ((negative)) [mg/dl]
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Urine microscopy

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ISOMORPHIC AND DYSMORPHIC ERYTHROCYTES: **from 60 to 70 in sight**

PRESENT:	singular bacteria
PRESENT:	red blood cells casts and hyaline cast

Arterial hypertension

Arterial hypertension is diagnosed in a child whose systolic and/or diastolic pressure BP measurement is ≥ 95. percentile for age, gender and height percentile, obtained from measurements made during 3 separate visits.

Acute proliferative glomerulonephritis

- It develops suddenly, after 1-3 weeks from streptococcal pharyngitis or 2-3 weeks after the appearance of skin lesions from streptococcus. Other pathogens can also cause the disease(in less cases).
- **Triada Addisa**: oedema (85%), hypertension (60–80%) and changes in the urine (erythrocyturia and red blood cell casts).
- Acute renal failure can occur, that in most cases subsides. A small number of patients require a renal replacement therapy.

Acute proliferative glomerulonephritis

- Changes in urinalysis:
- erythrocyturia,
- In about 30% of the sick haematuria,
- proteinuria,
- **cylindruria** (red blood cell , hyaline-granular and granular casts)
- In the phase-contrast microscopy, dysmorphic erythrocytes and acanthocytes are identified . In case of the occurrence of the apparent haematuria urine is brownish.

In most cases acute phase of the disease resolves spontaneously after a few or a dozen or so days. It can take over a year before changes in the urine fully subside and a minor proteinuria and erythrocyturia can persist even for a few years.

2

A mother came to the doctor with a 2-month-old girl because of the appetite loss and irritability that she has observed for 2 weeks, according to the mother the girl is also less active. In the medical history: the child with CII PI in the 40th week of pregnancy, birth weight 3500 g, received 10 points in the Apgar score. Vaccinated in accordance with the vaccination calendar.

In the physical examination the following was noted:partial dryness of the mucosa , tachycardia 170/min, the child was agitated.

A blood test was ordered, from the deviations: CRP: 8 mg/dl (N: 1 mg/dl), in the complete blood count leukocytosis 15 ,000/uL.

Which test was missing in the ordered tests?

Clarity clear ((transparent))

Colour yellow ((transparent yellow, yellow))

Glucosa negative ((negative)) [mg/dl]

Bilirubin negative ((negative))

Ketone bodies negative ((negative)) [mg/dl]

Specific gravity 1.010 (1.002-1.035)

pH 6.5 (5.0-7.5)

Protein trace ((negative)) [mg/dl]

Urobilinogen 0.2 (0.2-1.0) [E.U./dL]

Nitrite negative ((negative))

Blood trace ((negative))

Leukocyte esterase many ((negative))

Urine microscopy

WHITE BLOOD CELLS: from 35 to 45 in sight and in clusters of few leukocytes
ISOMORPHIC AND DYSMORPHIC ERYTHROCYTES: from 2 to 4 in sight

Clarity clear ((transparent))

Colour yellow ((transparent yellow, yellow))

Glucosa negative ((negative)) [mg/dl]

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Urine microscopy

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ISOMORPHIC AND DYSMORPHIC ERYTHROCYTES: from 2 to 4 in sight

Urinary tract Infection (UTI)

- In the group of children under 24 months of age with a body temperature above 38°C, without a determined cause, UTI has been confirmed in 5–7%.
- Symptoms are non-specific!
- **In all children under 24 months of age with a fever > 38°C without a palpable cause, UTI should be suspected and urinalysis should be made (urinalysis +urine culture examination)**
- Unidentified urinary tract infection in youngest children carries the risk of becoming generalised. Moreover, delay or lack of diagnosis and starting an appropriate treatment can pose a threat of creation a post-inflammatory scars in renal parenchyma.

UTI symptoms depending on the child's age

Child's age	Symptoms suggesting UTI
Infants from 2 to 12 months	Fever, aversion to eating, vomiting, lack of weight gain, anxiety and crying during miction,excessive sleepiness, change of colour, clarity and odour of urine
Children from 2 to 6 years old	Fever, vomiting, diarrhoea, loss of appetite,lack of weight gain, abdominal pain, excessive sleepiness, irritability, urination disorders, symptoms of dysuria, change of colour, clarity and odour of urine.
Children >6 years old	Fever,nausea and vomiting , abdominal pain,pain in the lumbar area, malaise,symptoms of dysuria,urination disorders, change of colour, clarity and odour of the urine.

Urine collection

Following methods of urine collection are recommended in children in order to establish an UTI diagnosis:

- for a general test any method
- for a microbiological test: the clean catch of urine method from the middle stream, urethral catheterization or suprapubic aspiration.
- **It is unacceptable to collect urine for culture from a bag taped in the perinaeum area.**

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An UTI diagnosis

- Diagnosis: a basic test confirming UTI is a microbiological urine test . In urinalysis >=10 leucocytes in sight increase a probability of a diagnosis.
- Apparent bacteriuria –value depends on the method of urine collection:
- Urine collected from the middle stream - increase over 10^5 CFU
- -Urine collected in the process of urethral catheterization – increase over 10^4 CFU
- Urine collected in the process of suprapubic aspiration – increase of bacteria , independently from the titre

UTI risk factors

- UTI in the medical history
- Presence of a diagnosed congenital urinary tract defect, including Vesicoureteral reflux (VUR).
- Abnormal ultrasound test results in the medical history, including prenatal tests.
- Positive family history for UTI (parents, siblings)
- Positive family history for congenital urinary tract defects, including VUR
- Bladder catherization
- Miction disorders
- Constipation, faecal incontinence
- Sexual activity in girls

Definitions

Lower urinary tract infection (bladder infection, cystitis)

Bladder infection – symptoms of dysuria

Upper urinary tract infection (acute pyelonephritis, acute interstitial nephritis)

Bacterial infection that involves the renal pelvis and renal intersitium, acute onset > 38°C, abdominal pain or positive Goldflam's sign + the symptoms from the lower urinary tract described above can occur.

In children below 24 months of age it is often difficult to determine the site of the infection

Definitions- cont.

Asymptomatic bacteriuria

Presence of bacterial strains in the urine in the relevant titre that does not cause an inflammatory response of the urinary tract.

Leucocyturia

Presence in the non-centrifuged urine more than 5 leucocytes in sight of the microscope (magnification- 400x) or 10 and more leucocytes in the centrifuged urine.

3

A mother came to a paediatrician with a 4-year-old boy because of the rash on the lower limbs,that appeared this morning. From mother's account the rash spread on the buttocks in the following hours, and also knee pain appeared. In the physical examination the doctor identified red ecchymosis on the lower limbs and on the buttocks raised above the level of the healthy skin and oedema of the knee joints. The child is in a good condition.

What possible diagnosis should the doctor think about?

Which tests should not be skipped?

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singular in the sample

IgA vasculitis (formerly known as Henoch-Schonlein purpura)

- Vasculitis in which in small vessels (mainly capillary vessels, veins and arterioles) immune complex deposition is identified, mainly IgA1.
- Acute onset. In about 50% of cases occurs after 1–2 weeks from an upper-respiratory tract infection, sometimes after inflammation of the digestive tract.
- Symptoms:

- skin lesions
- articular changes
- changes in the digestive tract
- renal changes – most often haematuria

IgA vasculitis (formerly known as Henoch-Schonlein purpura)

- Urinalysis is in most cases initially normal.
- Absence of changes in the urinalysis does not exclude a diagnosis.
- Regular check of the urinalysis after getting sick is applied.

Sources

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