Ministry of Health of Ukraine

Bogomolets National Medical University

GUIDELINES

to practical classes for students

Educational discipline: EQ 25 Pediatrics children's infectious diseases.

Field of knowledge: 22 "Health care"

Specialty: 222 "Medicine"

Pediatrics Department № 2

APPROVED

at the meeting of Pediatric Department № 2 of 26.08 2024, protocol №1

Reviewed and approved by Cycle Methodical Commission on

Pediatric Disciplines 29.08.2024 Protocol №1

Topic: Differential diagnosis of glomerulonephritis in children. Emergency care of acute kidney injury in children.

Competences

The student should ***know:***

- The subject field of pediatrics (prevention, diagnosis and treatment of diseases in children of various ages) and to understand professional activity: **causes, mechanisms of development, diagnosis and assistance to children of various ages with glomerulonephritis and chronic kidney disease.**
- examination methods and management tactics for children of various ages with glomerulonephritis.

be able:

- Collect data on the patient's complaints, anamnesis of disease, and anamnesis of life according to the standard scheme of the patient's survey, according to the established algorithms, conduct and evaluate the results of the physical examination of children of various ages with glomerulonephritis.
- Evaluate information about the diagnosis, applying a standard procedure based on the results of laboratory and instrumental studies of children of various ages with kidney pathology.
- Identify the leading clinical symptom or syndrome. Establish the most likely or syndromic diagnosis of the disease. Assign a laboratory and/or instrumental examination of a sick child. Carry out differential diagnosis of diseases in children of different ages. Establish a preliminary and clinical diagnosis in children of various ages with glomerulonephritis.
- Determine the principles and nature of treatment of acute and chronic glomerulonephritis in children of various ages.
- Determine the tactics of providing emergency medical aid in case of acute kidney injury. Indications for hemodialysis.
- Provide emergency medical care for acute kidney injury. Indications for hemodialysis.

The student should be able to:

- Collect medical information from children of various ages with kidney pathology and analyze clinical data.
- Determine the necessary list of laboratory and instrumental studies and evaluate their results in children of various ages with kidney pathology.
- Establish a preliminary and clinical diagnosis of kidney pathology in children of various ages.
- Determine the principles and nature of treatment of glomerulonephritis and complications in children of various ages.

The student should be able to demonstrate:

- Ability to apply knowledge in practical situations.
- Ability to work in a team.
- Ability to interpersonal interaction.

The student should have the following skills:

- Collect medical information about a patient and analyze clinical data.

- Provision of emergency medical care in outpatient and inpatient settings.
- Performing medical manipulations.

Didactic purpose:

- *Ensure that students* learn the etiopathogenesis, diagnosis and differential diagnosis of kidney diseases.
- *Control the degree of learning* of the algorithm for providing medical care for glomerulonephritis and emergency care for acute kidney injury.
- *Form students' skills* to evaluate a child's condition; determination of treatment tactics and provision of emergency care.

Equipment: dolls, phantoms, documentation (history of an inpatient f.003, history of child development f.112), medicines, instructions, tools for parenteral injections, textbooks, manuals, reference books, methodical recommendations, algorithms for performing practical skills. Academic journal, student's workbook.

Lesson plan and organizational structure

The name of the stage	**Description of the stage**	**Levels of assimilation**	**Time, 5.5 ac.h**
1. Preparatory	1.1. Organizational issues. 1.2. Individual oral survey. 1.3. Formation of motivations. 1.4. Control of the initial level of knowledge: Testing; checking home preparation for classes, workbooks; extracurricular work of students.	B B	**15-20%** **40 min**
2. Basic	2.1. demonstration of the thematic patient by the teacher; 2.2. independent work - curation of patients (history taking, objective examination, identification of symptoms, formation of syndromes, proposing and working out hypotheses regarding the preliminary diagnosis,	C	**60-65%** **170 min**

	formation of examination and treatment plan); 2.3. clinical examination of the patient with participation of the teacher. Differential diagnosis, evaluation of clinical data, results of laboratory and instrumental studies, treatment. 2.4. Acquisition and practice of practical skills.	C C, D	
3. The final stage	3.1. Control and correction of the final level of knowledge; 3.2. General evaluation of the student's educational activity, work analysis. 3.3. Informing students about the topic of the next lesson, detailing homework.	C	**20%** **40 min**

Test tasks for processing of the topic

CASE 1

The mother of a three-year old Asian boy with steroid-sensitive idiopathic nephrotic syndrome seeks advice regarding future therapy for her son. He has had four relapses of the nephrotic syndrome in the last year, each time responding rapidly to oral prednisone. Relapses have occurred when prednisone was tapered to <20 mg every other day. He now has reduced stature for his age and developed a behavioral disorder believed to be due to excess glucocorticoids. Another physician has advised the mother that a 10-week course of oral cyclophosphamide is essential to control her son's disease and to prevent further relapses. The mother, however, is very fearful of the adverse side effects of cyclophosphamide.

Which ONE of the following statements is correct?

A. Alternate drugs, other than cyclophosphamide, are available to control the disease at an acceptable level of side effect.

B. Continuation of glucocorticoid therapy is the best option.

C. A course of cyclophosphamide is indicated and is preferable to all other options.

D. All therapy should be stopped while awaiting a spontaneous remission.

E. No treatment advice can be given unless a renal biopsy is performed.

1.The correct answer is A. This patient has a multiple relapsing, steroid-dependent form of idiopathic nephritic syndrome, almost certainly due to a minimal change lesion. Glucocorticoid complications have developed and alternative strategies of

treatment are indicated. A renal biopsy is unlikely to contribute to therapeutic decision-making, even if a few focally sclerotic glomeruli were observed. Adjunctive therapy with cyclophosphamide, chlorambucil, cyclosporine, or levamisole would likely be associated with equivalent short-term results (remission of nephritic syndrome), but would have differing profiles of side effects. No treatment option is superior to another in terms of inducing a remission, and the decision on which to use is largely determined by the profile of adverse effects and the ability to produce a sustained remission without continuing treatment.

Link: Nelson Textbook of Pediatrics, 2-Volume Set, 21th Edition, 2016 by Robert M. Kliegman, Joseph St. Geme, Nathan J. Blum, Samir S. Shah, Robert C. Tasker, Karen M. Wilson, Richard E. Behrman – p. 508-536

CASE 2
A four-year old Africa-American boy develops idiopathic nephrotic syndrome associated with microscopic hematuria. His BP is 138/74mmHg, and he has massive anasarca. His serum creatinine is 0.8mg/dl, urine protein excretion is 12 g/day, serum albumin is 1.8 g/dl, and the serum cholesterol is 480mg/dl. Serum C3 and C4 concentrations are normal. Urinalysis reveals 10 to 15 erythrocytes per high-power field, numerous hyaline and granular and fatty acid casts, and oval fat bodies. The patient's mother refuses to permit a renal biopsy.
What would be the most appropriate initial therapy for the patient?
A. 40 mg/m2 prednisone daily for two weeks, then 20 mg/m2 every other day for an additional two weeks
B. 60mg/m2 prednisone daily for four weeks, then 40 mg/m2 for an additional four weeks
C. 500 mg of intravenous methylprednisone daily for three doses; repeat monthly for six months
D. 5mg/kg cyclosporin per day and 20mg of prednisone every other day for four months
E. 2.5mg/kg levamisole three times weekly for six months

2.The correct answer is B. This patient almost certainly has minimal change disease by clinical criteria. The initial treatment of choice is high dose daily prednisone for 4–6 weeks, followed by intermittent lower dose prednisone for an additional 4–6 weeks. IV methylprednisone will achieve equivalent short-term results but with a higher relapse rate. There is no need to consider alternative agents until a pattern of relapses has been determined during follow-up. Older male children with minimal change disease may require more intensive initial therapy. Lowdose, short-term prednisone treatment would likely be associated with a highrisk of relapse. A very low dose cyclosporine regimen could be used for older patients who refuse glucocorticoids or those who have contra-indications to steroid treatment.
Link: Nelson Textbook of Pediatrics, 2-Volume Set, 21th Edition, 2016 by Robert M. Kliegman, Joseph St. Geme, Nathan J. Blum, Samir S. Shah, Robert C. Tasker, Karen M. Wilson, Richard E. Behrman – p. 508-536.

CASE 3
A four-year old white girl is discovered to have microscopic hematuria during a routine examination. Her physical examination, including BP is normal. You see her for further investigation. History reveals that her younger sister, age six, also has persistent microscopic hematuria. There is no family history of deafness. The patient

denies flank pain, fever, urinary tract symptoms, or episodes of gross hematuria. Laboratory values include a serum creatinine of 0.6 mg/dl, and the urine shows 10 to 15 dysmorphic erythrocytes and 1 to 2 leucocytes per high-power field. No casts are seen. A 24-hour urine reveals 18mg of protein and a creatinine clearance of 210 ml/min. A random urine calcium-creatinine ratio is normal (<0.22). The random urine microalbumin-creatinine ratio is 35mg/g cratinine.
Which ONE of the following tests is most likely to reveal the correct diagnosis?
A. A renal biopsy
B. An abdominal ultrasound
C. An audiogram
D. A computerized tomography (CT) scan of the abdomen with contrast
E. A cystoscopy

3.The correct answer is A. This patient has many clinical features that are strongly suggestive of thin basement membrane nephropathy (persistent microscopic hematuria, minimal proteinuria, normal renal function and BP, and absence of deafness).
The dysmorphic erythrocytes points to a glomerular rather than a bladder or tubulointerstitial source for the hematuria. Cystic kidney disease, hydronephrosis or a renal seems unlikely, based on the history, physical examination, and urinalysis.
IgA nephropathy ought to be differentiated from Thin basement membrane disease (TBMD).Measurement of urinary microalbumin-creatinine ratio on a random urine specimen can differentiate IgA nephropathy from TBMD. In patients with TBMD, the urine microalbumin-creatinine ration is normal (<30 ug/mg), whereas in IgA nephropathy, the ratio is consistently elevated above the normal level. A renal biopsy with electron microscopy and measurement of glomerular basement membrane width will establish the diagnosis.
Link: Nelson Textbook of Pediatrics, 2-Volume Set, 21th Edition, 2016 by Robert M. Kliegman, Joseph St. Geme, Nathan J. Blum, Samir S. Shah, Robert C. Tasker, Karen M. Wilson, Richard E. Behrman – p. 508-536.

CASE 4
A seven-year old girl presents after having pedal and periorbital edema for three weeks. She denies gross hematuria, a recent upper respiratory infection, arthralgias, or skin rash. She has no history of diabetes mellitus and is not pregnant.
The physical examination is normal except for 4+ pedal edema. Her BP is 130/90mmHg. Laboratory tests reveal: BUN 26 mg/dl, plasma creatinine 1.3 mg/dl, plasma albumin concentration 2.4 g/dl, and a negative antinuclear antibody titer.
The urinalysis shows 4+ proteinuria, oval fat bodies, free fat droplets, 20–25 red cells/HPF, and occasional red cell casts. A 24-hour urinary protein excretion is 6.2 g.
What is the most likely diagnosis?
A. Lupus nephritis B. Membranoproliferative glomerulonephritis C. Focal segmental glomerulosclerosis
D. IgA nephropathy E. Hemolytic uremic syndrome

4.The correct answer is B. This woman has nephrotic syndrome but also a nephritic sediment. These findings plus edema, renal insufficiency, and mild hypertension suggest the presence of diffuse glomerulonephritis. In this age group, SLE membranoproliferative glomerulonephritis and, less often, anti-glomerular basement membrane antibody disease is the most likely diagnosis. The lack of systemic symptoms or antinuclear antibodies makes SLE improbable. Similarly, the absence of pulmonary hemorrhage and severe renal insufficiency are unusual in anti-GBM antibody disease. Thus, membranoproliferative glomerulonephritis seems to be the

leading diagnosis. This was confirmed by renal biopsy.
Link: Nelson Textbook of Pediatrics, 2-Volume Set, 21th Edition, 2016 by Robert M. Kliegman, Joseph St. Geme, Nathan J. Blum, Samir S. Shah, Robert C. Tasker, Karen M. Wilson, Richard E. Behrman – p. 508-536.

CASE 5. A 3-year-old girl with acute enteritis had repeated vomiting and frequent loose stools for two days. In a serious condition (pronounced weakness, pale skin, dry mucous membranes, daily diuresis of the previous day - 200 ml, no urination for 8 hours, blood pressure - 45/20 mm Hg) was hospitalized in the intensive care unit. In the general analysis of blood: HB-112 g / l, L. - 9,5 x10 / l, ESR - 27 mm / h, Ht - 52%, in biochemical: protein - 70 g / l, albumins - 45 g / l, globulins -25 g / l, urea -8.9 mmol / l, creatinine - 0.15 mmol / l, blood potassium - 5.8 mmol / l; in the general analysis of urine - protein - 0,132 g / l, leukocytes 8-10 in p / s, erythrocytes 10-12 in p / s, hyaline cylinders - 3-4 in p / s.
Where to start intensive care?
A. Enter intravenously: 5% solution of albumin - 10-15 ml / kg for 30 minutes.
B. Intravenously drip isotonic sodium chloride solution at a dose of 20 ml / kg for 30 minutes
C. Intravenously administer furosemide (2 mg / kg iv).
D.Intravenously administer glucose solution with insulin together with sodium bicarbonate solution
F. Dialysis
Correct answer: B. - to restore the volume of circulating blood, stabilization of hemodynamics and clarification of the answer to water-salt loading within 30 minutes in / in isotropically enter isotonic solution of sodium chloride in a dose of 20 ml / kg.
5% albumin solution - 10-15 ml / kg is administered for hypoproteinemia. Furosemide is administered - when the CAT is above 60 mm Hg. If the level of urea and creatinine increases, the oligoanuric stage of VOC is diagnosed, and glucose-insulin infusions are prescribed to control hyperkalemia, and sodium bicarbonate solution is administered according to BE indicators, if necessary. Indications for dialysis include the following:
• Anuria / oliguria
• The amount of overload with the presence of hypertension and / or shock lung
• Persistent hyperkalemia
• Severe metabolic acidosis that is not controlled by drug therapy
• Uremia (encephalopathy, pericarditis, neuropathy)
• Blood urea nitrogen> 100-150 mg / dL (or less if increasing rapidly)
• Calcium / phosphorus imbalance, in hypocalcemic uncontrolled tetany
to restore the volume of circulating blood
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Clinical Tasks.
1. Child, 8 years old. Hospitalized with complaints of weakness, poor appetite, nausea, swelling of the legs, 1 time there was vomiting. These complaints appeared yesterday.
Has been ill for 2 weeks, changes in urine tests were noted (increased number of erythrocytes and protein), but the parents refused hospitalization.
The child's condition is serious, the boy is lethargic and inactive. Pallor of the skin, periorbital edema, and legs pastiness are noted. Vesicular breathing is heard in the lungs. The boundaries of the heart have not changed. Heart sounds are sonorous, pulse 108 beats in 1 min. Blood pressure 130/70 mmHg. Art. The abdomen is soft on palpation, the liver near the edge of the costal arch, the spleen is not palpable.Urination three times a day. Diuresis 350 ml. Urine color is red.
Blood analysis: Er. – 3.5×1012 /l, Hb – 110 g/l, ESR – 3 mm/h, Le – 10 · 10 9 /l, eoz. – 2, neutrophils – 58, lymphocytes – 31, monocytes – 8, basophils – 0.5, urea 10.3 mmol/l, creatinine

– 0.2 mmol/l, total protein – 65.4 g/l, albumins 52 , globulins 48. Urine analysis: amount 10 ml, color - red, specific gravity - 1010, reaction - acid, protein - 2.0 g/l, Le - 8 in f/v, Er. – cover the entire field of vision, cylinders – 4 in f/v. Your diagnosis? Prescribe treatment.

Right answer: Acute glomerulonephritis with nephritic syndrome, a period of extensive clinical manifestations with impaired kidney function.
This diagnosis is indicated by clinical symptoms - edema, increased blood pressure, intoxication, red urine (hematuria), oliguria, in the urine analysis proteinuria corresponds to nephritic syndrome; elevated creatinine, serum urea indicate impaired kidney function.
Link: Marcdante Karen J., Kliegman Robert M. (eds.) Nelson Essentials of Pediatrics. 8th edition. — Elsevier, 2018. — 2301 p.

2. A 12-year-old girl was hospitalized with complaints of weakness, drowsiness, aversion to food, periodic abdominal pain. 3 weeks ago, she underwent an appendectomy complicated by peritonitis, received fluoroquinolones, was discharged in a satisfactory condition. Objectively: body weight deficit of 20%, pale, dry skin. BH - 30/min., heart rate - 108/min. The lungs and the heart - without features. The abdomen is accessible to deep palpation, sensitive in the epigastrium.
In the blood analysis: normochromic anemia, urea - 14 mmol/l, creatinine 0.2 mmol/l, hyperkalemia - 6.5 mmol/l. Specify the probable diagnosis. Treatment.

Right answer: Acute kidney demage, the development of which is obviously associated with appendicitis and the use of nephrotoxic antibiotics.
This diagnosis is indicated by intoxication and laboratory studies (anemia, increase in serum urea, creatinine, potassium). This indicates the need for hemodialysis.
Link: Marcdante Karen J., Kliegman Robert M. (eds.) Nelson Essentials of Pediatrics. 8th edition. — Elsevier, 2018. — 2301 p

Recommended Literatur

Fundamental:

1. Nelson Textbook of Pediatrics, 2-Volume Set (Nelson Pediatrics) 21st Edition by Robert M. Kliegman MD, Joseph St. Geme MD, 2020, 5932 p
2. Ghai. Essential Pediatrics. 9 edition.- 2019.-768 p.
3. Hugh D. Allen, Robert E. Shaddy,Daniel J. Penny. Moss & Adams' Heart Disease in Infants, Children, and Adolescents, Including the Fetus and Young Adult/ 9 Edition. -2016.-Volume 1. 3438p.

Additional

1.Bellomo R, Kellum JA, Ronco C: Acute kidney injury, Lancet 380:756–764, 2012.

2. An Update on Neonatal and Pediatric Acute Kidney Injury. ournal: Current Pediatrics

Reports, 2018, № 4, p. 278-290. https://ouci.dntb.gov.ua/en/works/ldrPoOo7/

. Questions for student self-preparation for practical lesson:

1. Glomerulonephritis: definition, etiology, pathogenesis.

2. Classification of glomerulonephritis.
3. Describe the syndromes in acute and chronic glomerulonephritis
4. Clinical and diagnostic criteria of acute and chronic glomerulonephritis
5. Differential diagnosis of acute and chronic GN.
6. Treatment of glomerulonephritis.
7. Acute kidney injury (AKI): definition, etiology, pathogenesis.
8. Diagnostic criteria of HUN.
9. Stages of HUN.
10. Emergency care for HUN.

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