Topic 21 - Acute kidney injury (AKI). Topic 22 - Chronic kidney disease (CKD).
(4 hours practical lesson)

Place
Classroom, Nephrology department

Purpose
To know:

- The main causes of acute kidney injury (AKI). Pathogenesis of lesions of individual organs and systems in dialysis, their clinical manifestations.
- Classification AKI. Features of clinic and development of AKI
- Methods of diagnosis and differential diagnosis of AKI, chronic renal failure (CRF).
- Treatment of AKI. Complication.
- The main causes of CKD. Pathogenesis of damage of individual organs and systems in chronic renal failure, their clinical manifestations.
- Features of the clinic at different stages of the development of CKD.
- Instrumental and laboratory diagnostic methods depending on the stage of CKD. Differential diagnosis.
- Modern principles of treatment and prevention on the different stages of CKD. Complications.
- Hemodialysis: the essence of the method, therapeutic effect, indications and contraindications, complications.
- Indications for kidney transplantation.

Professional orientation of students

AKI and chronic renal failure is a consequence of many diseases of the kidneys, which significantly worsens the prognosis and mortality is a factor in these diseases.

Basic knowledge and skills

№	Discipline	To know	To be able
1.	Anatomy	Anatomical structure of kidneys and urinary tract	Palpation of the kidneys
2.	Gistology	The structure and functioning of the nephron	To analyze the data of morphological studies of kidneys
3.	Biochemistry	Basics of nitrogen exchange	To interpret biochemical blood tests
4.	Pathophysiology	Mechanisms of urine formation and excretion	
5.	Propaedeutics of internal medicine	Semiotics of kidney and urinary tract diseases	To assess the clinical and laboratory studies

Plan for practical lesson

№	Elements of practical lesson	Time(minutes)
1.	Call over of the students	5
2.	Basic test control and its analysis	15
3. *	Distributing patients for supervision (medical history or clinical tasks)	10
4. *	Examination of the patient or studying of educational clinical task	40
5.	Discussion of findings, formulation of previous diagnosis, determination of methods of additional examination, interpretation of their results, formulation of final diagnosis and plan of treatment	50
6.	Solving clinical situation tasks and writing prescriptions	20
7.	Final knowledge control and its evaluation	15
8.	Results and final assessment of students knowledge and skills and tasks to self-preparation for the next lesson	5

Note: * - in the case of patients absence in clinic, practice can be made in the form of preparation and decision of situational tasks.

List of theoretical questions that should be reviewed during lesson

1. The main causes of ARI and CKD. Pathogenesis of ARI and CRF.
2. The clinical course of chronic renal failure, depending on the stage.
3. Classification of AKI and CRF.
4. Instrumental and laboratory methods for the diagnosis of AKI and CKD, according to the degree of CRF.
5. Differential diagnosis. Complications.
6. Treatment of ARI and CKD depending on the stage.
7. Hemodialysis: essence, therapeutic effect, indications and contraindications, complications.
8. Indications for kidney transplantation.

Methodology of practical classes

In the first lesson, the teacher conducts safety instruction (if there are such conditions), which is noted in the teacher's journal signed by the student.

The teacher conducts a written basic msqs control (a set of 15 tests is added according to the number of students: subgroup, group) after checking the students present at the class. (Annex 1)

The teacher divides students for the supervision of patients and determine their tasks.

№	Task	Instructions for students	Note

1.	To exam patient with CKD or AKI: Group the symptoms into syndromes, identify the leading syndrome, perform differential diagnosis, formulate a diagnosis, and appoint adequate treatment.	During examination student should determine: 1. Signs of renal failure 2. The presence of a cause that triggered or contributed to the development of CRF or AKI 3. Changes in laboratory analysis, ultrasound, X-ray are characteristic of CRF or AKI	Pay particular attention to: ● signs of autointoxication and compensatory changes from other organs and systems ● clinical course of chronic renal failure, symptoms, causes that led to the CRF, the quality of treatment of the underlying disease. ● presence of changes in laboratory and ultrasound studies, compliance with their stage of CRF and AKI ● determining the tactics and purpose of treatment for CRF and AKI.

Teacher works according to the plan for practical lessons. At the end of the lesson teacher should carry out control of knowledge and practical skills of each student. A set of control materials is added (situational and clinical tasks, tests, etc.). (Annex 2)

Ilustrative material

1. Tables and slides with AKI/CKD classification, treatment regimens.
2. Video with ultrasound examination of the kidneys with AKI/CKD.
3. Sets of analyzes, tests, situational tasks.

Forms and methods of self-control

Tests (Annex 1)

Situational tasks

1. A sick man of 27 years complains of headache, general weakness, nausea, dry mouth, itchy skin. Considers himself ill within 8 months when these complaints first appeared. In childhood frequent sore throats. He was treated at his place of residence. Objectively: the patient's general condition is severe. Pale skin and mucous membranes. Left border of heart + 3 cm from lin. mediaclavicularis, heart sounds muffled, pericardial friction noise at 5 points, heart rate - 60 per min, blood pressure 175/120 mm Hg. The tongue is coated with plaque. Liver + 3 cm. Kidneys are not palpable, a symptom named by Pasternatsky questionable. In the blood: Hb - 62 g / l, Er. - 1,8 x 10^9, ESR of 35 mm / h, creatinine - 1,2 mmol / l. Glomerular filtration of 15 ml/min. In urinalysis: protein - 1, 2 g / l, er. 20-25 in view, Leuk. - 3-4 in view, specific gravity 1005. Specify the most probable diagnosis. What is the cause of the patient's poor condition? Determine the prognosis of the disease.

1. A 52-year-old man complains of lack of appetite, periodic nausea, weakness, shortness of breath during physical activity. 20 years ago was diagnosed chronic glomerulonephritis. He felt well, so the examination did not pass and treated. He worked in a hot shop where he was constantly sweating and drinking lots of water and soft drinks. Complaints began to appear in

the last 3 months. Objectively: Pale skin and mucous membranes. The left heart border + 4 cm lin. mediaclavicularis, heart sounds muffled, pericardial friction noise at 5 points, Hr=Ps – 58', BP 210/130 mm Hg. The tongue is coated with plaque. Edge of liver + 4 sm. Kidneys are not palpable, a symptom named by Pasternatsky questionable. In the blood analysis: Hb - 70 g / l, Er. - 2,0 x 10^9, ESR - 35 mm / h, creatinine - 1, 3 mmol / l. Glomerular filtration rate - 10 ml / min. In urine analysis: protein is 1.0 g / l, er. 20-25 in view, Leuk. - 3-4 in view, specific gravity 1005. Make a clinical diagnosis. How should anemia be explained? What are the factors behind long-term compensation for nitrogen exchange disorders?

Sources of information

Basic:

1. Therapy. Course of lectures. Simferopol. -2003.- 444p**.**
2. Davidson's Principles and Practice of Medicine 23rd Edition. Edited by Stuart H. Ralston, Ian D. Penman, Mark W.J. Strachan, Richard P. Hobson
3. Harrison`s. Principles of internal medicine. Seventeenth Edition. Fauci, Braunwald, Kasper, Hauser, Longo, Jameson, Loscalo. 2008

Additional:

1. era-edta.org Guidelines
2. kdigo.org/guidelines/acute-kidney-injury/
3. kdigo.org/guidelines/ckd-mbd/
4. kdigo.org/guidelines/living-kidney-donor/
5. kdigo.org/guidelines/anemia-in-ckd/
6. kdigo.org/guidelines/blood-pressure-in-ckd/

Self-study program for students

Learn:

- The main causes of ARI and CKD. Pathogenesis of ARI and CRF. The clinical course of chronic renal failure, depending on the stage.
- Classification of AKI and CRF.
- Instrumental and laboratory methods for the diagnosis of AKI and CKD, according to the degree of CRF.
- Differential diagnosis. Complications.
- Treatment of ARI and CKD depending on the stage.
- Hemodialysis: essence, therapeutic effect, indications and contraindications, complications.
- Indications for kidney transplantation.

To Able:

• Conduct a clinical examination, make a plan for examination and treatment of patients with AKI and CKD.

Pay attention to the appointment of modern methods of treatment of AKI and CKD, the need for long-term therapy and clinical supervision of patients.

Annex 1

Basic control

1. What disease that causes to CRF primarily affects the glomerular apparatus of the kidneys?
A. Chronic glomerulonephritis.
B. Chronic pyelonephritis.
C. Kidney apostematiz.
D. Polycystic kidney disease.
E. Urolithiasis

2. What disease that causes CRF primarily affects the renal tubules and interstitial?
A. Amyloidosis.
B. Acute glomeruonephritis.
C. Chronic glomerulonephritis.
D. Chronic pyelonephritis.
E. Polycystic kidney disease.

3. What diseases most often leads to terminal CRF?
A. Amyloidosis, diabetes mellitus.
B. Chronic pyelonephritis, chronic glomerulonephritis.
C. Diseases of the connective tissue.
D. ICD, hydronephrosis.
E. Malignant hypertension, hypertensive disease.

4. What ECG signs confirm hyperkalemia in chronic kidney disease?
A. Frequent ventricular premature beats.
B. High T wave, widening of the QRS complex.
C. Lengthening the interval PQ, ventricular complex type QS.
D. Low-voltage ECG, abnormal Q wave.
E. Strongly pronounced right gram.

5. What ECG signs confirm hypokalemia in chronic renal failure?
A. Atrioventricular blockade.
B. Deviation of the electrical axis of the heart to the right and lengthening the interval PQ.
C. Flattening of the T wave and the appearance of a pronounced U wave.
D. Severe bradycardia and sinus arrhythmia
E. Supraventricular extrasystoles.

6. What are the levels of serum creatinine and glomerular filtration (GFR) in terminal CRF?
A. Above 0.72 mmol / l; 10% and below due.
B. Above 0.92 mmol / l; below 5% of due.
C. Below 0.13-0.18 mmol / l; above 60%.

D. 0.13-0.18 mmol / l; above 50% of due.
E. 0,19-0,71 mmol / l; 50% - 10% and lower than should.

7. How many stages does the CKD classification have?
A. 2.
B. 3.
C. 4.
D. 5.
E. 6.

8. What is the relative density of urine in the sample according to Zimnitsky characteristic of severe CKD?
A. Above 1025.
B. Below 1000.
C. 1004 - 1011.
D. 1004 - 1025
E. 1015 - 1025.

9. What is the value of GFR in a healthy person?
A. Above 150 ml / min.
B. Below 50 ml / min.
C. Depends on the level of blood pressure.
D. 90-120 ml / min.
E. 50-80 ml / min.

10. Which component of the diet is restricted to patients with chronic kidney disease?
A. Carbohydrates.
B. Cellulose.
C. Fat
D. Proteins.
E. Starch.

11. What kind of anemia most often occurs with chronic renal failure?
A. Hemolytic.
B. Hypoplastic.
C. Microspherocytic.
D. Post-hemorrhagic.
E. Sickle cell.

12. What are the indications for referral of a patient to programmed hemodialysis?
A. Acute renal failure.
B. GFR 10-30 ml / min; creatinine 0,19-0,71 mmol / l.
C. GFR less than 10ml / min; creatinine above 0.72 mmol / l.
D. Malignant hypertension with treatment failure.
E. The patient has bilateral renal artery stenosis.

13. Which antibiotic group has the greatest nephrotoxicity?
A. Aminoglycosides.
B. Cephalosporins.
C. Fluoroquinolones
D. Macrolides.

E. Penicillins.

14. Which group of drugs used to treat infectious complications has minimal kidney toxicity?
A. Aminoglycosides.
B. Any group in combination with diuretics
C. Cephalosporins.
D. Fluoroquinolones.
E. Tetracyclines.

15. An absolute contraindication to hemodialysis program?
A. Congestive heart failure.
B. Diabetic nephropathy.
C. Incipient pulmonary edema due to overhydration.
D. Pericarditis.
E. Persistent oligoanuria

Final control

1. The most credible factor of bradikardia of CRF is:
   A. Hyperkaliaemia.
   B. Hypernatyaemia.
   C. Hypocalciaemia.
   D. Hyponatyaemia.
   E. Hypokaliaemia

2. A 48-year-old woman complains of weakness, weight loss, decreased appetite, headache. In childhood, she suffered acute glomerulonephritis. From the age of 25 she has been suffering from hypertension. Systematically not treated, rarely consulted a doctor. After the study revealed signs of chronic renal failure II degree (creatinine - 0.43 mmol / l). What nutrition recommendations are most justified for this patient?
A. Eating high-fat foods
B. Fat Restriction
C. Increase in fluid volume
D. Protein restriction
E. Restrictions on hydrocarbons

3. The 39-year-old patient went to the doctor complaining of morning headache, decreased appetite, nausea, morning vomiting, recurrent nasal bleeding. At the age of 15 suffered acute glomerulonephritis. The examination showed an increase in blood pressure up to 220/130 mm Hg, hemorrhage on the skin of the hands and feet, pallor of the skin and mucous membranes. Which of the biochemical damage has diagnostic significance in this case?
A. Blood bilirubin
B. Blood creatinine
C. Blood sodium
D. Fibrinogen
E. Uric acid

4. In a patient of 35 years suffering from chronic glomerulonephritis. For the last 3 years he has been on hemodialysis, there were interruptions in the activity of the heart, hypotension, growing weakness, shortness of breath. On the ECG: bradycardia, atrioventricular block I, high T. The

day before - a gross violation of drinking and diet regimes. What is the most likely reason for these changes?
A. Hyperkalemia
B. Hyperhydration
C. Hypernatremia
D. Hypocalcaemia
E. Hypokalemia

5. Woman 50 years, chronic pyelonephritis, during acute period got combination of anti-infectives - gentamicin (80 mg 3 times on days) and biseptol (960 mg 2 times on days). Can this combination of antibiotics result in what consequences?
A. Acute adrenal insufficiency
B. Acute kidneys failure
C. Chronic kidneys failure
D. Combination of antibiotics is optimum and fully safe
E. Glomerulosklerosis

6. Male 55 years, complains of general weakness, decreasing the output of fluid, pain in the heart aching character. For 15 years, suffering from chronic pyelonephritis treated in hospitals. Objectively: skin dry, yellowish. Ps- 80 / min, rhythmic, BP- 100/70 mm Hg. During auscultation of the heart - tones are deaf, the noise of friction of the pericardium. After additional studies: creatinine - 1.1 mmol / l, glomerular filtration 5 ml / min. What treatment is shown to the patient?
A. Antibiotics
B. Diuretics
C. Hemodialysis
D. Reopolyglukin
E. Xylitol, sorbitol

7. Patient 37 years delivered to the intensive care unit. The overall condition is very bad. Sopor. The skin is gray in color, moist. The pulse is frequent, intense. BP - 160/110 mm Hg. Increased muscle tone. Hyperreflexia. The smell of ammonia in the air. What is the previous diagnosis?
A. Alcohol coma
B. Brain Coma
C. Hyperglycemic coma
D. Hypoglycemic coma
E. Uremic coma

8. A patient of 24 years complains of nausea, vomiting, headache, shortness of breath. He had acute nephritis at 10 years old. Proteinuria in urine. Objectively: the skin is gray-pale, no edema. Second tone accent over aorta. BP - 140 / 100-180 / 100 mm Hg. The level of blood content of residual N2-6,6 mmol / l, creatinine - 406 mmol / l. Daily diuresis - 2300 ml, nocturia. Urine density is 1009, albumin - 0.9 g / l, WBC-0-2. RBC - single, hyaline cylinders single in sample. What is your diagnosis?
A. Chronic nephritis with impaired renal function
B. Hypertension II degree
C. Nephrotic syndrome
D. Pheochromocytoma
E. Stenosis of the renal artery

9. A patient with acute respiratory infection (day 3 of illness) complains of pain in the lumbar region, nausea, anuria. Urine analysis - hematuria (100-200 red blood cells in the field of view), specific gravity - 1002. Blood creatinine level is 0.18 mmol / l, potassium - 6.4 mmol/l. What is your diagnosis?
A. Acute glomerulonephritis
B. Acute cystitis
C. Acute pyelonephritis
D. Acute renal colic
E. Acute renal failure

10. The 33-year-old patient has acute blood loss (erythrocytes - 2.2 • 1012 / l, Hb - 55 g / l), blood group - A (II) Rh +. Accidentally, the patient received a transfusion of donor erythrocytes of group AB (IV) Rh +. An hour later the patient became restless, complaining of abdominal pain and lumbar pain. Ps-134 beats / min, BP-100/65 mm.Hg., body temperature - 38.6 C. After catheterization of the bladder was obtained 12 ml/h of dark brown urine. What is the complication?
A. Acute renal failure
B. Allergic reaction to donor red blood cells
C. Cardiac shock
D. Citrate intoxication
E. Toxic infectious shock