

Ministry of Health of the Republic of Belarus
Education Establishment
"Gomel State Medical University"
Normal Physiology Department

It was discussed at the department meeting 30.08.16
The protocol № 8

METHODICAL INSTRUCTION

for carrying out classes by teachers with the 2nd course students
of Faculty for training specialists for foreign countries (teaching in English)
on normal physiology

Topic: Excretion. Mechanisms of urine formation, physical and chemical properties

The general time of the class – 4 hours

**1. THE STUDYING AND EDUCATIONAL PURPOSES, THE MOTIVATION FOR
ASSIMILATION OF THE SUBJECT, REQUIREMENTS TO THE INITIAL LEVEL OF
KNOWLEDGE**

Purposes of the class

To master techniques of definition of glucose and protein in urine and to get acquainted with a technique the express – diagnostic test of definition of physical and chemical properties of urine.

Motivational characteristic of the subject

The medical student needs to know physiological value of excretion processes, their participation in maintenance of homeostasis. The organs which are carrying out excretory function. The student has to know basic provisions of the filtration -reabsorption theory, the role of various departments of a nephron in formation and concentration of urine, and also neuro and humoral mechanisms of regulation of kidneys activity.

Tasks of the class

During the class the student has to know the main indicators of the urine analysis, the most often used in clinical practice, and also methods of definition of glucose and protein in urine, the combined express diagnostic test of definition of separate physical and chemical properties of urine.

As a result of carrying out the class the student has to:

To know:

- physiological value of processes of excretion, their participation in maintenance of homeostasis;
- the basic concepts and terms on the class subject;
- the organs which are carrying out excretory function;
- basic provisions of the filtration -reabsorption theory, the role of various departments of a nephron in formation and concentration of urine ;
- neuro- and humoral mechanisms of a regulation of kidneys activity.

To be able:

To define glucose and protein in urine and to use a technique of the express – diagnostic test of definition of physical and chemical properties of urine.

2. CONTROL QUESTIONS FROM RELATED SUBJECTS:

1. Kidney structure: renal pelvises, calyces, renal pyramids, medullar layer of a kidney, including it "internal and external zones", kidney cortex, papilla.

2. Nephron structure: to distinguish renal (Malpigean) body, a glomulus (glomerular capillaries) and segments of tubules. Types of nephrons, structure of a cortical and juxtamedullar nephron.

3. Features of blood supply of kidney. The regional blood stream in cortical and medullar substance of a kidney.

3. CONTROL QUESTIONS ON THE CLASS SUBJECT:

1. Physiological value of processes of excretion. The organs which are carrying out excretory function (kidneys, skin, lungs, gastrointestinal system). Excretory and not excretory functions of kidneys.

2. Nephron as morpho -functional unit of kidney. Types of nephrons. Features of blood supply of kidneys.

3. Filtration -reabsorption theory of an uropoiesis. The main processes which are the cornerstone of uropoiesis. Functional value of the main parts of a nephron.

3.1 Features of a structure of the filtering membrane. Effective filtration pressure. Primary urine, its daily quantity, structure.

3.2 Tubular reabsorption. Mechanisms of tubular reabsorption in various sites of tubules of a nephron and collective tubules. Clearance. Threshold and not threshold substances.

3.3 The mechanism of osmotic concentration of urine in a nephron tubules. Multiplying rotary and counter-current system. The mechanism of osmotic concoction of urine in a distal segment and in collective tubes. Urea circuit.

3.4 Tubular secretion. Mechanisms of secretion and excretion in renal tubules.

4. Final urine. Physical properties, chemical composition, quantity. Clinical analysis of urine. Methods of a research of kidneys function. Entering of urine from kidneys in a bladder. Urination and its regulation.

5. Homeostatic functions of kidneys. The role of kidneys in maintenance of the acid and base state, osmotic pressure, ionic structure of blood, water and electrolytic balance. The role of kidneys in regulation of arterial pressure and systemic blood flow.

6. Nervous and humoral regulation of an uropoiesis. Renin, angiotensin, vasopressin, aldosteronum, natriuretic hormone, their influence on functions of kidneys and circulation. Anti-diuresis, water and osmotic diuresis.

Reports:

1 Clinical methods of assessment of functional abilities of kidneys.

2. Consequences of removal of a kidney. Artificial kidney.

4. PRACTICAL PART OF THE CLASS

Laboratory work 28.1. Definition of protein in urine.

Laboratory work 28.2. Definition of sugar in urine.

Laboratory work 28.3. The combined express-diagnostic test for definition of certain physical-chemical properties of urine.

Laboratory work 28.4. Calculation of rate of glomerular filtration.

Laboratory work 28.5. Calculation of a clearance of a creatinine.

5. THE COURSE OF THE CLASS

- *Introduction:* Students ask the teacher questions which caused certain difficulties in the course of independent mastering of education material;

- *Demands to the initial level of knowledge:* - From sections of anatomy and histology students have to know the most important structural elements of a kidney, a structure of a nephron and its types.

- *Correction of initial level of knowledge:* The student answers control questions on the class subject "Excretion physiology". In this section it is necessary to pay attention to basic provisions of the filtration - reabsorption theory and functions of various departments of a nephron in formation and concentration of urine, and also neurohumoral mechanisms of regulation of kidneys activity.

- *Setting of problems which will be solved by students:* The teacher sets a task to master techniques of definition of protein and glucose in urine, and also to get acquainted with the combined express-diagnostic test for definition of certain physical-chemical properties of urine.

- *Independent performance of tasks by students:*

- students make out the protocol of class with the subsequent discussion of a technique of performance;

- students perform practical work under control of the teacher and laboratory assistant. For performance of work students are provided with methodical guiding and the necessary equipment. Presentation is provided by tables and drawings.

- students read reports on the class subject with the subsequent discussion.

- *Assessment of final level of knowledge of the class subject:* The teacher specifies the final level of knowledge of students of theoretical and practical questions, the basic concepts and terms, and also knowledge of basic physiological constants of a class subject;

- Viewing of the video

- *Fixing of knowledge:* Students solve situational problems of a subject of class and answer test questions;

- *The conclusion of the teacher and a task to the next class:* At the end of class the teacher does the conclusion about the carried-out work and tells students the home task for independent work. Then summing up class and signing of protocols of experience, and also assessment of practical skills in a leaf of their account is carried out.

Note: time of breaks of 15 minutes during the class.

6. QUESTIONS FOR SELF-CHECKING OF KNOWLEDGE

1. a) The patient has bleeding therefore average arterial pressure decreases by 25%. How do you think what will happen to indicators of rate of a glomerular filtration and a renal blood flow?

b) It is known that the sharp lowering of arterial pressure (a collapse, shock) is followed by the termination of release of urine (anuria). How is it possible to explain this fact?

2. How would function of kidneys change if "to straighten" Genle's loop?

3. To lesion of what part of a nephron does the appearance of protein in urine testify?

4. Why is there diuresis augmentation at long starvation ?

5. How will the rising of intra renal pressure affect processes of an uropoiesis (for example, at ureteral occlusion)?

6. What climatic conditions are optimum for patients with a chronic renal failure?

7. Concentration of urea in urine is always much higher, than in plasma. Whether is it bound to the fact that the main process to which urea is exposed in a kidney tubules is secretion?

LITERATURE

Basic

1. Human physiology: textbook for overseas students = Физиология человека: учеб. пособие для иностранных студентов, обучающихся на английском языке / А. И. Киеня [и др.]; под ред. проф. Э. С. Питкевича; пер. на англ. яз. Р. А. Карпов, В. А. Мельник. — Гомель: УО ГoГМУ, 2009. — 352 с.

2. Text of lectures.

Alternate

1. Textbook of medical physiology // C. Guyton, 2006. — 1116 p.

2. Human anatomy and physiology // Alexander P., Spence-Elliott B. Masson.

3. Human physiology. The mechanisms of body function // Arthur J. Vander James H Sherman Dorothy S. Luciano, 1986. — 715 p.

4. Lecture notes on human physiology // John J Bray, Patricia A. Cragg, Anthony D.C. Macknight, Roland G. Mills and Douglass W. Taylor.

5. Human anatomy and physiology // Elaine N. Marieb, 1989. — 995 p.

6. Review of medical Physiology, International edition, 2003. — 912 p.