LESSON № 11

Topic: DISORDERS OF WATER-ELECTROLITE METABOLISM

Aim of the lesson: to study disorders of water-mineral metabolism, mechanisms of dehydratation and edema development, and their complications.

QUESTIONS:

1. Water-electrolite balance. Its regulation.
2. Classification of water-electotite disturbances.
3. Negative water-mineral balance. Hypo-, iso- and hyperosmolaric types of dehydration. Causes, mechanisms of development, manifestations and consequences.
4. Positive water-electrolite balance (overerhydration). Types, causes, mechanisms of development, manifestations, consequences, and principles of treatment.
5. Water poisoning. Causes, symptoms and consequences. Therapy.
6. Edema. Classification. Factors of edema development.
7. Pathogenesis of cardiac, renal, hepatic, inflammatory, allergic, toxic edemas.
8. Disorders of sodium, potassium, calcium, manganese, and phosphate metabolism: causes, manifestations, and mechanisms of development.
9. Disturbances of microelements metabolism (J, F, Mn, Se, Cu etc).

Tasks

1

Examination of a 32-year-old patient revealed various signs of pathology, .rciuuing excessive body mass: his height is 168 cm and weight 84.5 kg. The patient also has a pasty face, periorbital puffiness, pale skin; he had slow rebound of tissue to its original contour after pressing the feet or shin with the fingertip. The patient told the physician about tightness of a ring and shoes m me evening. The investigation of the cardiovascular system revealed the following:

minor arterial hypotension, areas of cardiac dullness are slightly increased: other parameters are unremarkable. The daily urine volume is withing the normal range.

- What is the possible cause of the patient’s excess of body mass?
- C an we assume that water-ions balance is deranged in this patient?
- What type of edema is observed in the patient?
- What additional data are required to specify the type of edema in this case?

2

A 42-year-old patient has been admitted to hospital with a diagnosis of uncompensated chronic heart failure due to valvular disease. The patient has normal constitution with paucity of subcutaneous tissue. His height is 165 cm, body weight 81 kg. On examination: the patient needs to sit in bed; he has dyspnea, acrocyanosis, marked lower extremities edema, rales and wheezes during auscultation of the chest. An X-ray investigation of the abdominal area shows an accumulation of fluid: the liver is enlarged; stroke volume and cardiac output are decreased: hematocrit 38%; the daily urine volume is decreased. Biochemical tests reveal an increased plasma activity of renin and an increased sodium concentration.

- Are there any signs of derangement of water balance in this patient?
- What type of dyshydria is observed in this case?
- Is there any association between the accumulation of fluid in the subcutaneous tissue, the abdomen, and the lungs?
- Explain pathogenesis of increased blood levels of renin and Na~ in this patient.
- Explain pathogenesis of edema in this patient.
- Explain the role of edema in deterioration of the patient’s condition.
- What therapeutic approaches can be used to treat edema in this case?

3

A 22-year-old patient who recovered from severe scarlet fever two weeks ago complains of headache, pain in the back, dyspnea, and palpitations. During the last week she has increased her body weight by 11,5 kg. On examination: her face is pale; she has periorbital puffiness and edema of the shins and feet; the boundaries of the heart dullness are increased: blood pressure is 180/100 mm Hg; the daily urine volume is reduced. Urine tests show the presence of erythrocytes and protein. An increased titer of antistreptolysin O antibodies is found in the blood.

- Is there evidence of the kidney damage in this patient? What is the possible mechanism of this pathology?
- What is the cause of hyperhydration in this case: a decrease in water excretion or an increase in water retention?
- Explain the mechanisms of edema in this patient.

4

A 7-year-old boy developed a progressive swelling of the soft palate with a swallowing difficulty, and then asphyxia after he had drunk mango juice. The mucosal membrane in the swelled area is hyperemic without tenderness; a moderate increase in eosinophils is seen in the blood. The patient's body temperature is normal. His senior sister suffers from attacks of bronchial asthma.

- Is edema in this case the result of ordinary inflammation?
- What is the cause of edema in this patient?
- Explain the pathogenesis of the given pathology.
- Does this type of edema lead to life-threatening condition?

LITERATURE:

1. General and clinical pathophysiology / ed. by A.V. Kubyshkin. – Vinnytsa: Nova Knyha Publishers. – 2011. – P. 338-343, 348-359.
2. Litvitsky P.F., Pirozhkov S.V., Tezikov E.B. Pathophysiology: Concise Lectures, test, clinic-pathophysiological situations and clinic-laboratory problems. Students manual / Moscow «Geotar-Media». – 2012. – P. 50-55.
3. General and systematic pathology / ed. by J. C.E. Underwood. 2nd ed. – 1996. – P. 145-150.