Kidneys II

Kidneys II – production of hypo and hyperosmotic urine, fluid balance practice

**Laboratory exercise and seminar in medical physiology**

Home preparation, study materials and learning objectives

**Learning objectives - what you will be able to do**

• Describe the formation of the corticopapillary osmotic gradient in the kidney

• Explain the mechanism of countercurrent exchange in the vasa recta.

• Describe the method of excretion of antidiuretic hormone and the principle of its action in the kidneys

• Explain how fluid balance in the body is maintained in cases of different fluid intake.

**Studying materials**

• Lecture Formation of concentrated urine

(the recording of the lecture from 2020 can be found here: https://www.youtube.com/watch?v=QoK6QSzi688)

• Textbook L. Constanzo – Physiology, 6th or 7th edition

o Water balance – concentration and dilution of urine (Pages 298 – 307)

• Additional resources:

o Guyton AC, Hall JE: Textbook of Medical Physiology. Elsevier, 2020. (Chapter 28: Regulation of Extracellular Fluid Osmolarity and Sodium Concentration)

**Preparing a presentation**

• Two students will prepare a presentation on the topic: **Formation of the corticopapillary osmotic gradient by the mechanism of countercurrent multiplication in Henley's loop.** Urea recycling in the kidney. Countercurrent exchange in the vasa recta. (approx. 15 minutes)

**Home preparation**

**1. Study the Water balance - a guide for students**

**2. Based on the acquired knowledge, answer the questions in writing about a clinical case of syndrome of inappropriate secretion of antidiuretic hormone (SIADH)**

Mr. KS is a 68-year-old mechanical engineer who retired 1 year ago, when he was diagnosed with oat cell carcinoma of the lung. Always an active person, he has tried to stay busy at home with consulting work, but the disease has sapped his enegy. After dinner one evening, his wife noticed that he seemed confused and lethargic. While he was sitting in his recliner watching television, he had a grand mal seizure. His wife called paramedics, who took him to the emergency department of the local hospital. In the emergency department, the information below was obtained:

Plasma Na+ 112 mEq/L (normal, 140 mEq/L)

Plasma osmolarity 230 mOsm/L (normal, 290 mOsm/L)

Urine osmolarity 950 mOsm/L

Oat cell carcinomas of the lung may secrete antidiuretic hormone (ADH). Unlike ADH secretion from posterior pituitary, ectopic hormone secretion from the cancer cell is not feedback-regulated. As a result, blood levels of ADH can become extraordinarily high.

Questions:

1. What is the major effect of these levels of ADH on kidney?

2. Explain Mr. KS urine osmolarity, plasma Na+ concentration and plasma osmolarity.

3. Why did Mr. KS have a grand mal seizure?

Mr. KS was treated immediately with an infusion of hypertonic (3%) NaCl. He was released from the hospital a few days later, with strict instruction to limit his water intake.