

**Comenius University in Bratislava, Faculty of Medicine**  
**Institute of Medical Chemistry, Biochemistry and Clinical Biochemistry**

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LABORATORY PROTOCOL SS - 7<sup>th</sup> seminar  
**Concentration and acidification test of kidneys**

Name, study group:	Date:
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### Concentration test

Principle:

The concentration test is used to determine the ability of the kidneys to produce hyperosmolar urine of high density (above 1030 g/L). This test is usually used in differential diagnosis of unexplained polyuria. **A sufficient effect of antidiuretic hormone (ADH) in the distal tubule and collecting duct is crucial for this ability of the kidneys, for which there must be sufficient ADH in the blood and at the same time the kidneys must be sensitive to it.**

There are two ways to test concentration ability of the kidney:

- let the patient without water (usually during the night)
- administer synthetic ADH to the patient

Combination of both methods is often used. The patient does not drink during night and subsequently, the density and/or osmolarity of urine is measured in the morning. If the value of these parameters is higher than the reference value for the respective age group, the conclusion is that the concentration ability of the kidneys is normal. If the density is not increased enough despite the lack of fluids, the second method is used, during which synthetic ADH is administered intranasally.

If the kidneys are able to increase the density of urine after administration of synthetic ADH, then the polyuria is probably caused by insufficient secretion of ADH (**central diabetes insipidus – hypothalamus or pituitary problem**). If the kidneys are unable to increase the density of urine after administration of synthetic ADH, then the polyuria is probably due to insensitivity of the kidneys to ADH (**nephrogenic diabetes insipidus**).

Procedure:

The ability of the kidneys to concentrate the urine after a lack of fluids during the night is tested. On the first day, the patient has his last meal at 18:00, after which he does not take any more liquids or food. The next day, at 6:00 in the morning and at 12:00, urine samples are collected and subsequently their density is measured.

Calculation:

Patient 1 (45-year-old male)		Patient 2 (37-year-old male)	
1 <sup>st</sup> day 18:00 (0 hour)		1 <sup>st</sup> day 18:00 (0 hour)	
2 <sup>nd</sup> day 6:00 (12 hours)		2 <sup>nd</sup> day 6:00 (12 hours)	
2 <sup>nd</sup> day 12:00 (18 hours)		2 <sup>nd</sup> day 12:00 (18 hours)	

Reference values:

Normal density of urine: **1015 – 1030 g/L**

age group	15 – 30 years	31 – 50 years	51 – 70 years
density of urine should increase during concentration test	over 1030 g/L	over 1028 g/L	over 1026 g/L

Conclusion:

## **Acidification test**

### Principle and procedure:

The acidification test is used to determine the kidney's ability to excrete  $H^+$  after administration of an acidic compound (usually ammonium chloride -  $NH_4Cl$ ). However, this test is not suitable for patients with failing kidneys or significant impairment of liver function. The patient drinks a dose of  $NH_4Cl$  or  $CaCl_2$  (0.1 g/kg of body weight) in 500 mL of water or tea, in the morning at 6:00-6:30 on an empty stomach. After that the patient can eat (except milk) and, if necessary, can go to toilet. Urine is collected from 9:00 to 13:00 in collection container. The pH is determined in the collected urine samples: under basal conditions (before administration of acidic compound) and in the 4-hour collected urine (after administration of acidic compound).

### Calculation:

Patient 1		Patient 2	
before acidification	4-hour urine	before acidification	4-hour urine

### Reference values:

Normal kidneys are able to acidify urine during this test, which **leads to decrease of pH in urine under 5.5.**

### Conclusion:

### **Next week:**

The roles of calcium and phosphates in the organism – Calcium and phosphorus  
(Study material: uploaded to MS Teams MF\_Medical Biochemistry-GM or D\_2023-2024)