

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

LABORATORY PROTOCOL SS07

Concentration and acidification test of kidneys

Name, group:	Date:
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Concentration test

Principle:

Concentration test is used to determine ability of kidneys to produce hyperosmolar urine of high density (over 1030 g/l) and we usually use this test in differential diagnosis of unexplained polyuria. **Sufficient effect of antidiuretic hormone (ADH) in the distal tubulus and collecting duct is crucial for this ability of kidney.** There has to be enough ADH in the blood and the kidney has to be sensitive for this ADH. We can test concentration ability of the kidney in two ways:

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

We often use combination of both of these ways. We let the patient spend the night without drinking any water and we measure the density and/or osmolality of urine in the morning. If the value of these parameters is higher than the reference value for the respective age group, we conclude, that the concentration ability of the kidney is normal. If the density is not high enough despite the liquid deprivation, we continue the test using the second method, during which we administer synthetic ADH intranasally. If the kidneys react to the synthetic ADH by increasing density of the urine, then the explanation of polyuria is probably insufficient secretion of ADH (**central diabetes insipidus – hypothalamus of pituitary problem**). If the kidneys do not react to the synthetic ADH, then the problem is kidney insensitivity to ADH (**nephrogenic diabetes insipidus**).

Procedure:

In this laboratory experiment we test concentration ability of kidneys after water deprivation during the night. Patient eats dinner at 18:00 of the 1st day and after that he eats or drinks nothing. At 6:00 in the morning we take a sample of urine and measure its density using urometer. Patient does not eat or drink for another 6 hours and at 12:00 we measure density of the urine. We compare the measured value with reference values for respective age group.

Calculation:

Patient 1 (45-year-old male)		Patient 2 (37-years-old male)	
1 st day 18:00 (0 hours)		1 st day 18:00 (0 hours)	
2 nd day 6:00 (12 hours)		2 nd day 6:00 (12 hours)	
2 nd day 12:00 (18 hours)		2 nd 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 + procedure:

Acidification test is used to determine ability of the kidneys to excrete H^+ after administration of acidic compound, usually ammonium chloride (NH_4Cl). Before this test we had better make sure, the patient does not suffer from renal failure or decrease of liver functions. Patient will drink a solution of NH_4Cl (0.1 g/kg of body weight) or $CaCl_2$ (0.11 g/kg of body weight) in 500 ml of water or tea in the morning at 6:00-6:30. After that the patient can eat (but not drink any milk) and can go to toilet, if he needs to. Last urination into the toilet should be at 9:00. After that the patient collects urine into the collecting vessel until 13:00. After this we take a sample of the 4-hour urine and measure pH of this sample.

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: