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ASSESSMENT OF ALUMINUM SALTS INFLUENCE ON INDEXES OF ION REGULATIVE RENAL FUNCTION IN MATURE AND IMMATURE RATS AGAINST THE BACKGROUND OF THE PINEAL GLAND HYPOFUNCTION

Abstract. *Deterioration of public health is due to anthropological environmental pollution, particularly by aluminum compounds. The question about the impact of aluminum salts on the ion regulatory function of the kidney has not been studied sufficiently. In order to assess the impact of nephrotoxic action of aluminum salts on the ion regulatory function of the kidney, and under the conditions of hypothyroidism of the pineal gland, we studied the effect of 14-day action of aluminum chloride compounds on the ion regulatory function in 24 white male rats. It was found that the environmental stress of aluminum salts is accompanied by a nephrotoxic effect, which is characterized by the development of the loss of sodium ions with urine due to a damage of the nephron tubular portion. Hypofunction of the pineal gland causes a nephrotoxic effect of aluminum salts in mature rats with a more significant manifestation of the syndrome of loss of sodium ions in the urine.*

Key words: *kidneys, aluminum chloride, pineal gland.*

Introduction. In recent years, public health in Ukraine has deteriorated significantly, due to anthropological environmental pollution, including compounds of aluminum, which influence everybody daily [1, 6, 8, 10]. Human aluminum requirement is 35-40 mg / day, exceeding this dose over 100 mg / day results in significant changes in the biological systems of the human body, including the kidney [2, 3, 4]. Despite the prevalence of aluminum compounds, the question about the impact of aluminum salts on the ion regulatory function of the kidney in mature and immature rats has not been studied sufficiently [5, 7, 9].

Objective: to study the influence of toxic effects of aluminum chloride on the ion regulatory renal function in mature and immature rats and under the conditions of hypothyroidism of the pineal gland.

Materials and methods. The experiments involved 24 mature and immature nonlinear male albino rats weighing 0,06-0,10 kg and 0,14-0,20 kg respectively. We studied a nephrotoxic effect of aluminum salts on ion regulatory renal

function. Aluminum chloride in a dose of 200 mg / kg was administered intragastrically daily within 14 days of the experiment at 8.00 am and 8.00 pm with the 1% starch slurry. Hypothyroidism of the pineal gland was simulated by keeping the animals in conditions of constant illumination (24.00L: 00D) for 7 days. The ion regulatory function was assessed in terms of excretion of sodium ions and their concentrations in the urine, absolute and relative cation reabsorption, filtration charge and sodium ions clearance, sodium-potassium urine factor, concentration of sodium ions in the plasma concentration index of sodium ions, the values of the proximal and distal transport.

Results and discussion. The assessment of the ion regulatory renal function in intact immature rats which were administered aluminum salts (Table. 1) showed that the concentration of sodium ions in the urine increased. The excretion of sodium ions tended to increase. The filtration fraction of sodium ions in the conditions of administering aluminum salts in immature rats was characterized by a

downward trend compared to the control. The clearance of water free of sodium ions tended to reduce in the conditions of administering aluminum salts in immature rats.

Table 1

Values of the ion regulatory function of the kidney in intact immature rats under the influence of aluminum salts ($\bar{x} \pm S_x$)

Values	Immature rats (Al) (n=6)	Control (n=6)
1	2	3
The concentration of sodium ions in the urine mmol / l	1,5±0,29	0,5±0,05 p<0,01
The excretion of sodium in urine mmol / 2h · 100 g	2,43±0,76	0,99±0,23
Filtration fraction of sodium ions, umol / min. · 100 g	17,5±5,44	25,51±5,32
The excretion of sodium, umol / min · 100 g	2,54±0,72	1,08±0,19
The excretion of sodium, mg / 100 ml Ccr	0,03±0,01	0,009±0,0004
Clearance of sodium-free water	1,62±0,16	2,2±0,27
Concentration index of sodium, stand. units.	0,01±0,002	0,003±0,0003 p<0,01

Note: 1. p – reliability of differences compared with the group of immature rats.

2. n – the number of observations.

The concentration index of sodium ions increased reliably. The distal reabsorption of sodium ions tended to reduce due to the administration of aluminum salts in immature rats.

An analysis of ion regulatory renal function values in mature intact rats after introducing

aluminum salts (table 2) showed that the concentration of sodium in the urine increased. Filtration fraction of sodium ions in case of introducing aluminum salts in mature rats was characterized by a downward trend compared to the control. The trend towards the growth

Table 2

Values of the ion regulatory function of the kidney in intact mature rats under the influence of aluminum salts ($\bar{x} \pm S_x$)

Values	Mature rats (Al) (n=6)	Control (n=6)
1	2	3
The concentration of sodium ions in the urine mmol / l	1,9±0,15	0,7±0,03 p<0,001
The excretion of sodium in urine mmol / 2h 100 g	3,23±0,56	1,96±0,26
The excretion of sodium, umol / min 100 g	3,46±0,43	2,17±0,17 p<0,02
The excretion of sodium, mg / 100 ml Ccr	0,03±0,01	0,01±0,006
Clearance of sodium-free water, ml / 2 h 100 g	1,95±0,31	3,19±0,08 p<0,01
Relative reabsorption of sodium ions, %	98,7±0,95	99,5±0,38
Clearance of sodium ions ml / 2 h · 100 g	0,03±0,004	0,01±0,0002 p<0,05
Concentration index of sodium, stand. units.	0,01±0,001	0,005±0,0002 p<0,001

Note: 1. p – reliability of differences compared with the group of mature rats.

2. n – the number of observations.

was recorded for the excretion of sodium ions, standardized by the glomerular filtrate speed. The clearance of sodium-free water experienced a decrease in terms of administration of aluminum salts in mature rats. Relative reabsorption of sodium tended to be inhibited. The clearance of sodium was growing. The concentration index of sodium ions increased reliably.

An analysis of the values of ion regulatory renal function in mature and immature rats after introducing aluminum salts against the

background of the pineal gland hypofunction (table 3) showed that the concentration of sodium in the urine was higher in mature rats. We established a similar pattern regarding the excretion of sodium ions. The trend towards growth was recorded for the excretion of sodium ions, standardized by the glomerular filtrate rate. The distal reabsorption of sodium ions after introducing aluminum salts in mature rats tended to decrease. The proximal reabsorption in the comparison group was higher in mature rats.

Table 3

Values of the ion regulatory function of the kidney in mature and immature rats under the influence of aluminum salts against the background of the pineal gland hypofunction ($\bar{x} \pm S_x$)

Values	Mature rats (Al) (n=6)	Immature rats (Al) (n=6)
1	2	3
The concentration of sodium ions in the urine mmol / l	3,48±0,46	1,02±0,05 p<0,001
The excretion of sodium in urine mmol / 2h · 100 g	7,27±1,68	2,22±0,56 p<0,02
Filtration fraction of sodium ions, umol / min. · 100 g	33,02±10,13	22,77±5,05
The excretion of sodium, umol / min · 100 g	8,13±1,31	2,39±0,49 p<0,01
The excretion of sodium, mg / 100 ml Ccr	0,05±0,01	0,03±0,01
Distal reabsorption of sodium ions, micromoles/ 100 ml Ccr	0,87±0,26	1,96±0,14 p<0,01
Proximal reabsorption of sodium ions, micromoles/ 100 ml Ccr	23,31±9,21	24,87±8,06

Note: 1. p – reliability of differences compared with the group of mature rats.

2. n – the number of observations.

Conclusions. 1. The analysis of aluminum salts influence on the ion regulatory renal function in mature and immature rats showed that the studied environmental stress is accompanied by a nephrotoxic effect, which is characterized by the development of the loss of sodium through urine nephron tubular damage.

2. Hypofunction of the pineal gland causes nephrotoxic effect of aluminum salts in mature rats with a significant manifestation of the syndrome of loss of sodium in the urine.

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