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KIDNEY AND URIC ACID METABOLISM

Y. O. Karmazin, O. M. Karmazina, I. A. Paliienko

Department Propedeutics of Internal Medicine N 2
Bogomolets National Medical University, Kyiv, Ukraine

Summary: Considered a complex system of regulation of metabolism of uric acid in the kidney, which is carried out of urate transporters of proximal tubules of nephrons.

Key words: uric acid, kidney, filtration, excretion, reabsorption, secretion.

Uric acid is the end product of metabolism of purines in humans. Purines are extremely important substances contained in the cells and extracellularly. Two derivatives of purines − adenine and guanine are part of the nucleic acids (DNA and RNA). The level of uric acid in the body depends on the intensity of degradation and synthesis of purines, reusing of purine bases, amount of purine compounds that come from food and intensity of excretion of uric acid by the kidneys and through the gastrointestinal tract [1, 2, 4, 5].

About 70% of uric acid excreted by the kidneys, and the rest - through the gastrointestinal tract, saliva, bile, mucous membrane of the stomach and intestine.

There is a complex system of renal of urates, which includes the successive stages of filtration (100% content of urates in the blood), reabsorption (98-100% of filtered urates), secretion (50% of reabsorbed urates) and re-reabsorption (40% of the secreted urates) [1, 5].

This system is highly dependent on genetic factors and sensitive to various physiological and pathogenic effects.

The main group of proteins that are involved in the transport of urates is localized in the proximal tubules of the nephron.

Group of urates transporters that are expressed on the apical side of the proximal tubules of the kidneys were called "uric acid

transportosomes".

These include glucose transporter type 9 (GLUT-9, also known as SLC2A9); urate anion transporter 1 (URAT1, also known as SLC22A12); organic anion transporters 6, 8, 11 and 13 (SLC22A6, SLC22A8, SLC22A11 and SLC22A13, also known as OAT1, OAT3, OAT4 and ORCTL-3); multi-drug resistance-associated protein 4 (MRP4); sodium-coupled transporters monokarboksylat 1 and 2 (SLC5A8 and SLC5A12) and ATP-binding cassette sub-G member 2 (ABCG2) [4].

The secretion of urates is provided by transport of urates from the blood through the epithelial cells of the basal membrane by transporters SLC22A6 and SLC22A8 and removing of it from the lumen of the tubule epithelial cells through apical membrane by transporters SLC22A13, SLC17A1, SLC17A3, MRP4 and ABCG2.

Reabsorption of urates through the the apical membrane of epithelial cells is carried by urate-anionic exchangers URAT1, SLC22A13, which transport urates of urine into the cell in exchange for monocarboxylates.

Glucose transporter GLUT-9b reabsobes urates through the apical membrane, and glucose transporter GLUT-9a displays urates of epithelial cells through the basal membrane into the blood [5, 10].

The concentration of a saturated solution of uric acid in serum at 37 ° C is 416 mmol / L (7 mg / dL). Exceeding this threshold is a prerequisite for the crystallization of urate. However, the blood contains substances that increase it's solubility, so usually crystallization does not occur even when the concentration of uric acid in serum is 4800 mmol / L (80 mg / dL). In particular, its binding with protein increases solubility by 70% [8, 9].

In urine uric acid dissolves better in water than perhaps due to the presence of urea, protein and glicosaminoglicanos. Its solubility depends on the pH. At pH equal to 5, the solubility of uric acid in the urine is 360-900 mmol / L (6-15 mg / dL), and at a pH level of 7 - 9480-12000 mmol / l (158-200 mg / dL). Part of uric acid in the urine

is in the form of salts: monosodium, disodium, potassium, ammonium and calcium.

Urine at pH 5 is saturated with urate in concentration of 15 mg / dl. As the pH of the urine of healthy people normally lower uric acid pKa (dissotiation constant) (5.75), urinary urate consist mainly of uric acid. If the urine pH is 7, then it can dissolve urate 150-200 mg per 100 ml. Uric acid is the main form of urate in the urine pH below pH 5.75. Such pH is typical for distal tubules and collecting tubules of the kidneys. If uric acid crystals are formed in the zone of proximal section of acidification of urine, it will be urate crystals of sodium, in the area of acidification are formed crystals of uric acid. Therefore, most of the stones that form in the urinary tract, composed of uric acid. The intensity of uric acid stone formation can be reduced by shifting the urine pH in alkaline direction (thus prevail more soluble form - sodium urate) [3, 6, 7].

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РЕЗЮМЕ

НИРКА ТА МЕТАБОЛІЗМ СЕЧОВОЇ КИСЛОТИ

Кармазін Я.О., Кармазіна О.М., Палієнко І.А.

(Київ)

Розглянута складна система регуляції обміну сечової кислоти в нирці, яка забезпечується уратними транспортерами проксимальних канальців нефронів.

Ключові слова: сечова кислота, нирка, фільтрація, екскреція, реабсорбція, секреція.

РЕЗЮМЕ

ПОЧКА И МЕТАБОЛИЗМ МОЧЕВОЙ КИСЛОТЫ

Кармазин Я.Е., Кармазина Е.М., Палиенко И.А.

(Киев)

Рассмотрена сложная система регуляции обмена мочевой кислоты в почке, которая осущестеляется уратными транспортерами проксимальных канальцев нефронов.

Ключевые слова: мочевая кислота, почка, фильтрация, экскреция, реабсорбция, секреция.