Introduction

According to the European League against Rheumatism (EULAR)’s recommendation, hyperuricemia is an uric acid level increase over 360 mcmol/l in women and 420 mcmol/l in men [1]. The prevalence of this pathology among the world’s population is 5-12% [2, 3]. Taking into account a large number of references on the uricosuric estrogen properties preventing hyperuricemia in women, studies of uric acid level in the postmenopausal individuals gains more prominence each year [2, 4]. Gout is known to develop in women during menopause, accompanied by the diuretic use (in order to treat the arterial hypertension or to achieve weight loss). The prevalence of uric acid metabolism disorders in women over 50 is 35% [5]. There is a well-documented association of hyperuricemia and endothelial dysfunction (promoting atherosclerosis) and oxidative stress (promoting atherosclerotic plaques) [6, 7, 8, 9]. According to the National Collaborating Center for Primary Care (2006), obesity with a body mass index (BMI) ≥ 30 results in hyperuricemia’s risk rising by 2-3 times in adults [1, 10]. Despite the fact that the uric acid is referred to as a risk factor of various diseases, namely a metabolic syndrome, scientific findings reveal a positive influence of hyperuricemia on bone metabolism [11, 12]. For instance, it is stated that uric acid has antioxidant properties while oxidative stress is often blamed for its negative impact on bone tissue.

As of today, in Ukraine there are few studies documenting BMD values of patients with various uric acid rates. The US and Australian scientists proved a lower fracture frequency and higher BMD in patients with elevated uric acid rates; they also claim oxidative stress as a key pathogenic factor explaining this fact. Thus, knowing an individual uric acid rate, one may predict a likelihood of osteopenia, osteoporosis and fractures, performing a primary diagnostics of these conditions in the localities where there are no accessible diagnostic tools for osteoporosis.

Our aim is to study the structural-functional bone state (bone mineral density, bone quality) and components of metabolic syndrome in postmenopausal women with various uric acid rates.

Materials and methods

The study was held at the Department of Clinical Physiology and Pathology of Locomotor Apparatus, State Institu-
tution “D.F. Chebotaryov Institute of Gerontology” by the NAMS of Ukraine and the Ukrainian Scientific-Medical Center of Osteoporosis. 412 postmenopausal women were examined, among whom 4 groups were determined depending on their BMI: I group (BMI=18.5-24.9) – normal, II group (BMI=25.0-29.9) – pre-obesity, III group (BMI=30.0-34.9) – obesity of Type I, IV group (BMI>35) - obesity of Type II. According to the uric acid blood serum rate, 4 groups were further outlined by quartile method: Q1 < 235 mcmol/l, Q2 = 235-281 mcmol/l, Q3 = 282-329 mcmol/l, Q4 > 329 mcmol/l.

Determining the uric acid blood serum rate required (uricase-peroxidase) enzymatic method and spectrophotometric analysis.

Determining the total spine BMD, lumbar spine BMD, femoral BMD, Ward triangle, hip and radius BMD was performed by means of «Prodigy» machine (CE Medical systems, model 8743, 2005).

Trabecular bone quality (TBS (L1-L4)) was measured by the installed TBS iNsight® software and X-ray densitometer (Med-Imaps, Pessac, France).

Statistical analysis included parametric and non-parametric criteria and required Statistica 6.0 software and Microsoft Office Excel.

Results and discussion

Our results show the highest uric acid blood serum rates in postmenopausal women with the highest BMI (BMI>35), i.e. the highest obesity rate. Furthermore, in the I group this parameter was 277.52 ± 8.40 mcmol/l; in the II group – 286.81 ± 7.79 mcmol/l; in the III group – 291.81 ± 7.56 mcmol/l; in the IV group – 327.17 ± 12.17 mcmol/l. The frequency of hyperuricemia among the postmenopausal women was: in the I group – 10.2 %; in the II group – 15.9 %; in the III group – 21.2 %; in the IV group – 34.2 %.

A significant dependence between the uric acid rate and body mass was determined in postmenopausal women (r=0.21, p<0.05) (Fig. 1).

It was found that postmenopausal women manifest a significant dependence between some lipid metabolism parameters, namely very-low-density lipoproteins (VLDLs) (r=0.40, p<0.05), triglycerides (r=0.26, p<0.05) and atherogenicity coefficient (r=0.24, p<0.05) (Fig. 2,3,4).

It was revealed that the osteoporosis frequency was lower in the group of patients with hyperuricemia compared to patients with normal uricemia. Thus, in the hyperuricemia group it was 19 % while in the normal uricemia group it was 34 % at the lumbar spine level, 17 and 21 % at the femoral neck level, respectively. The osteopenia frequency in the hyperuricemia group was 37 % at the lumbar spine level and 49 % at the femoral neck level, while in the normal uricemia group it was 30 % and 53 % respectively.

When the quartile analysis was used to distribute the uric acid rates, 4 groups of patients were determined (Q1 < 235 mcmol/l; Q2 = 235-281 mcmol/l; Q3 = 282-329 mcmol/l; Q4 > 329 mcmol/l). A significant difference of femoral neck BMD values and ultradistal BMD levels was found between Q1 and Q4 groups (BMD Q1 = 0.789 g/cm2 and BMD Q4 = 0.842 g/cm2; BMD Q1 = 0.711 g/cm2 and BMD Q4 = 0.773 g/cm2, p < 0.05, respectively) (Fig.5).

The quartile analysis did not reveal any significant uric acid rate difference depending on bone quality between Q1 and Q4 groups (p > 0.05).

Our results point out the fact that patients with a high uric acid rate have a lower osteoporosis frequency, while the BMD values, namely at the femoral neck and ultradistal radius levels are significantly higher in those patients with higher uric acid rates in blood serum.

Postmenopausal age may be considered one of the risk factors for hyperuricemia’s development. It is proved that postmenopausal women have a significant dependence of age, body mass and some lipid metabolism parameters. This is why, a conventional test for the uric acid rate may be considered an obligatory component of examination if a woman is over 50, in order to prevent cardiovascular pathologies, metabolic syndrome and other somatic disorders associated with a protracted hyperuricemia. There is a reliable correlation among the uric acid rate, body mass index, very-low-density lipoproteins (VLDLs), triglycerides and atherogenicity coefficient.
Conflicts of interests. Author declares the absence of any conflicts of interests and their own financial interest that might be construed to influence the results or interpretation of their manuscript.

References


Received 03.02.2020
Revised 14.02.2020
Accepted 02.03.2020

Information about author
G.S. Dubetska, PhD, Rheumatologist, Department of clinical physiology and pathology of locomotor apparatus, State Institution "O.F. Chebotarev Institute of Gerontology of the NAMS of Ukraine", Kyiv, Ukraine

Дубецька Г.С.
ДУ «Інститут геронтології імені Д.Ф. Чеботарьова» НАМ України, м. Київ, Україна

Структурно-функціональний стан кісткової тканини, гіперурикемія та компоненти метаболічного синдрому в жінок у постменопаузальному періоді

Резюме. У статті подано результати досліджень щодо вивчення рівня сечової кислоти в жінок у постменопаузальному періоді з урахуванням показників індексу маси тіла, ліпідного обміну та мінеральної щільності кісткової тканини. Найвищий рівень сечової кислоти у сироватці плазми крові виявлено в жінок у постменопаузальному періоді з найвищим індексом маси тіла (ІМТ > 40,0 усл.ед.). У жінок у постменопаузальному періоді існує вірогідна залежність між кісткової кислотою та показниками ліпопротеїдів дуже низької щільності (r = 0,401, р < 0,05), тригліцеридами (r = 0,26, р < 0,05), коефіцієнтом атерогенності (r = 0,24, р < 0,05). Частота остеопорозу була нижчою в групі пацієнток із гіперурикемією порівняно з особами з нормоурикемією. Так, у групі пацієнтів з гіперурикемією вона становила 19 %, а в пацієнтів із нормоурикемією — 34 % на рівні поясничного відрізку хребта, 17 і 21 % — на рівні шейки стегнової кістки відповідно.

Ключові слова: гіперурикемія; сечова кислота; ожиріння; індекс маси тіла; ліпідний обмін; метаболічний синдром; мінеральна щільність кісткової тканини; якість кісткової тканини

Дубецька Г.С.
ГУ «Інститут геронтології імені Д.Ф. Чеботарьова» НАМ України, г. Києв, Україна

Структурно-функціональне состояние костной ткани, гиперурикемия и компоненты метаболического синдрома у женщин в постменопаузальном периоде

Резюме. В статье представлены результаты исследований по изучению уровня мочевой кислоты у женщин в постменопаузальном периоде с учетом показателей индекса массы тела, липидного обмена и минеральной плотности костной ткани. Самый высокий уровень мочевой кислоты в сыворотке крови у женщин в постменопаузальном периоде составляет наименьший индекс массы тела (ИМТ > 35,0 усл.ед.). У женщин в постменопаузальном периоде существуют достоверные зависимости между уровнем мочевой кислоты и показателями липопротеидов очень низкой плотности (r = 0,401, р < 0,05), триглицеридами (r = 0,26, р < 0,05), коэффициентом атерогенності (r = 0,24, р < 0,05). Частота остеопороза была ниже в группе пациенток с гиперурикемией по сравнению с лицами с нормоурикемией. Так, в группе пациентов с гиперурикемией она составляла 19 %, а у пациентов с нормоурикемией — 34 % на уровне поясничного отдела позвоночника, 17 и 21 % — на уровне шейки бедренной кости соответственно.

Ключевые слова: гиперурикемия; мочевая кислота; ожирение; индекс массы тела; липидный обмен; метаболический синдром; минеральная плотность костной ткани; качество костной ткани