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DISCRIMINATIVE MODELS OF THE POSSIBILITY OF VARIOUS FORMS OF URTICARIA OCCURRENCE AND CHARACTERISTICS OF THE COURSE IN UKRAINIAN MEN DEPENDING ON THE CHARACTERISTICS OF THE STRUCTURE AND BODY SIZE

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In Ukrainian men, on the basis of the characteristics of body structure and size, reliable discriminative models were built, which allow with a high probability to classify the subjects as "typical" for practically healthy or urticaria patients (correspondingly, the correctness of 83.6 % of cases, Wilks' Lambda statistic=0.113). Taking into account the structure and body size indices among men with urticaria, a reliable interpretation of the obtained classification indices is possible only between acute and chronic forms of the disease (correspondingly, the correctness of 60.0 % of cases, Wilks' Lambda statistic=0.620).

Key words: skin diseases, urticaria, anthropometric and somatotypological indices, discriminant models, men.

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ДИСКРИМІНАНТНІ МОДЕЛІ МОЖЛИВОСТІ ВИНИКНЕННЯ ТА ОСОБЛИВОСТЕЙ ПЕРЕБІГУ РІЗНИХ ФОРМ КРОПИВ'ЯНКИ В УКРАЇНСЬКИХ ЧОЛОВІКІВ У ЗАЛЕЖНОСТІ ВІД ОСОБЛИВОСТЕЙ БУДОВИ ТА РОЗМІРІВ ТІЛА

В українських чоловіків на основі особливостей показників будови та розмірів тіла побудовані достовірні дискримінантні моделі, які дозволяють з високою ймовірністю віднести досліджуваних до «типових» для практично здорових або хворих на кропив'янку (відповідно коректність 83,6 % випадків, статистика Wilks' Lambda=0,113). При урахуванні показників будови та розмірів тіла між хворими на кропив'янку чоловіками можлива достовірна інтерпретація отриманих показників класифікації лише між гострою та хронічною формами захворювання (відповідно коректність 60,0 % випадків, статистика Wilks' Lambda=0,620).

Ключові слова: шкірні захворювання, кропив'янка, антропометричні та соматотипологічні показники, дискримінантні моделі, чоловіки.

The study is a fragment of the research project "The latest aspects of diagnosis, course, development and implementation in practice modern methods of chronic dermatoses and STDs complex treatment", state registration No. 0119U000712.

Hives, or as it is also called urticaria, is an inflammatory disease of human skin and is clinically manifested as smooth or erythematous swelling of the skin with severe itching. The basis of this disease is the degranulation of mast cells, which can be caused by both immunological and non-immunological mechanisms. The trigger can be both mechanical irritation of the skin, and infectious diseases, medication, food intake, systemic concomitant diseases, etc. According to the duration of symptoms, acute urticaria is distinguished when the duration of the disease is less than 6 weeks, and chronic urticaria – when the disease lasts more than 6 weeks [10].

According to various data, in 25–75 % of patients, the duration of this disease is more than 1 year and causes, in addition to obvious problems with physical health, psychological problems as well. More than 30 % of patients have anxiety and depression. In addition, there is a negative impact on the quality of life. The last and no less important is the significant cost of treatment, which ranges from 900 to 2,400 US

dollars (at purchasing power parity, which in general, taking into account direct and indirect losses, can reach 15,500 dollars) [5].

Data from 18 studies involving 86 million people revealed a heterogeneous prevalence of urticaria in different populations. Thus, in Asian countries the prevalence was 1.4 %, in Europe 0.5 % and the lowest in North America – 0.1 %. A slight predominance of female patients and an increase in the prevalence of urticaria with increasing age have also been established [4].

These trends regarding prevalence characteristics are also confirmed in the analysis of the German population, which included more than 4.5 million people. Among the most frequent concomitant diseases noted by the researchers are: hypertensive diseases (43.5 %), lipoprotein metabolism disorders (32.1 %) and affective disorders (26.0 %) [12].

The established features of the prevalence of urticaria among people of different ethnic groups, people of different sexes and ages [13] suggests the possibility of the existence of certain connections regarding the risk of the occurrence of this disease and somatotypological indices.

The purpose of the study was construction and analysis of discriminant models of the possibility of occurrence and characteristics of the course of urticaria in Ukrainian men, depending on the indices of structure and body size.

Materials and methods. On the basis of the department of skin and venereal diseases with a post-graduate course of National Pirogov Memorial Medical University, Vinnytsya and the Military Medical Clinical Center of the Central Region, clinical-laboratory and anthropo-somatotypological (according to the schemes of Bunak V. V. (1941), Carter J. and Heath B. (1990), Matiegka J. (1921) and the American Institute of Nutrition (Shephard R. J., Shephard R. F., 1991) [1]) examination of 40 young men (25–44 years old according to the age periodization of WHO, 2015) with acute and chronic urticaria of mild and severe course. Committee on Bioethics of National Pirogov Memorial Medical University, Vinnytsya (protocol No. 11 From 23.12.2021) found that the studies do not contradict the basic bioethical standards of the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine (1977), the relevant WHO regulations and laws of Ukraine.

As a control group, anthropometric and somatotypological indices of practically healthy men (n=82) of a similar age group were used, which were taken from the data bank of the research center of the National Pirogov Memorial Medical University, Vinnytsya.

Discriminative models of the possibility of occurrence and characteristics of the course of urticaria in Ukrainian men, depending on the indices of structure and body size, were built with the help of the license package “Statistica 6.0”.

Results of the study and their discussion. When dividing Ukrainian men into practically healthy and patients with acute and chronic urticaria of mild and severe course, taking into account anthropometric and somatotypological indices, the discriminant function covers 83.6 % of cases. It was established that skinfold thickness (ST) on the thigh and side, endomorphic component of the somatotype, width of the distal epiphysis (WDE) of the lower leg, transverse lower thoracic diameter, intertrochanteric and interspinous distance, the muscle component of body mass according to Matiegka are the discriminating variables between practically healthy men and patients with various forms of mild and severe urticaria, among which ST on the side and intertrochanteric distance have the greatest contribution to discrimination. In general, the totality of all anthropometric and somatotypological variables has a pronounced (Wilks lambda statistic=0.113; $p<0.001$) discrimination between healthy and patients with various forms of urticaria in Ukrainian men.

With the help of the determined coefficients of classification discriminant functions, it is possible to determine the classification index (Df), which allows you to attribute the obtained anthropo-somatotympological indices to "typical" for healthy or patients with various forms of various courses of urticaria in men. Below in the form of equations, the definition of the Df index is given, where it is possible to refer to practically healthy men with a Df value close to 240.9; to men with mild acute urticaria – with a Df value close to 211.4; to men with severe acute urticaria – with a Df value close to 231.5; to men with mild chronic urticaria – with a Df value close to 216.7; to men with severe chronic urticaria – with a Df value close to 206.3:

– Df (for healthy men) = ST on thigh ×0.110 + ST on the side ×0.269 - endomorphic component of the somatotype ×3.387 + WDE shin ×26.00 - transverse lower thoracic diameter ×0.504 + intertrochanteric distance ×9.008 + interspinous distance ×2.257 - muscle component of body mass according to Matiegka ×1.274 - 240.9;

– Df (for men with severe acute urticaria) =- ST on thigh ×0.698 + ST on the side ×1.276 - endomorphic component of the somatotype ×8.057 + WDE shin ×20.92 + transverse lower thoracic

diameter ×0.842 + intertrochanteric distance ×6.774 + interspinous distance ×3.596 - muscle component of body mass according to Matiegka ×0.965 - 211.4;

– Df (for men with severe acute urticaria) =- ST on thigh ×0.703 + ST on the side ×2.189 - endomorphic component of the somatotype ×11.65 + WDE shin ×21.12 + transverse lower thoracic diameter ×0.627 + intertrochanteric distance ×7.558 + interspinous distance ×3.881 - muscle component of body mass according to Matiegka ×1.205 - 231.5;

– Df (for men with mild chronic urticaria) =- ST on thigh ×0.888 + ST on the side ×1.722 - endomorphic component of the somatotype ×9.330 + WDE shin ×21.41 + transverse lower thoracic diameter ×0.626 + intertrochanteric distance ×7.359 + interspinous distance ×3.505 - muscle component of body mass according to Matiegka ×1.175 - 216.7;

– Df (for men with severe chronic urticaria) =- ST on thigh ×0.659 + ST on the side ×1.723 - endomorphic component of the somatotype ×10.29 + WDE shin ×19.66 + transverse lower thoracic diameter ×1.069 + intertrochanteric distance ×6.411 + interspinous distance ×3.967 - muscle component of body mass according to Matiegka ×1.011 - 206.3;

where (here and in the following), ST dimensions – in mm; endomorphic component of the somatotype – in points; WDE of long tubular bones – in cm; transverse dimensions of the trunk and pelvis – in cm; indices of the component composition of body weight – in kg.

The calculated χ^2 criterion allows you to determine the statistical significance of all discriminant functions (Table 1). From the results presented in Table 1, it can be seen that taking into account the parameters of body structure and size, a reliable interpretation of the obtained classification indices is possible only between practically healthy and sick men.

Table 1

Report of a step-by-step analysis including the χ^2 criterion for all canonical roots in practically healthy and urticaria men taking into account indices of body structure and dimensions

	Eigen-value	Canonicl R	Wilks' Lambda	Chi-Sqr.	df	p-level
0	5.887	0.925	0.113	249.4	32	0.0000
1	0.191	0.401	0.780	28.43	21	0.1286
2	0.053	0.225	0.929	8.386	12	0.7543
3	0.022	0.146	0.979	2.458	5	0.7828

Notes: here and in subsequent similar tables, Eigenvalue – value of the roots for each discriminant function; Canonical R – canonical value of R for different roots; Wilks' Lambda – Wilks' Lambda statistic; Chi-Sqr. – standard criterion χ^2 of successive roots; Df – number of degrees of freedom; p-level – the p-level is associated with the corresponding χ^2.

When dividing Ukrainian men into acute urticaria of a mild and severe course and chronic urticaria of a mild and severe course, taking into account anthropometric and somatotypological indices, the discriminant function covers 60.0 % of cases. It was established that among male patients with various forms of mild and severe urticaria, the discriminating variables are the bone component of body mass according to Matiegka and shoulder width, among which the bone component of body mass according to Matiegka has the greatest contribution to discrimination. In general, the totality of all anthropometric variables has a slight (Wilks lambda statistic=0.620; $p<0.01$) discrimination between Ukrainian men with different forms of urticaria.

In the form of equations, the definition of the Df index is given, where the classification of patients with acute urticaria of a mild course to men – with a Df value close to 178.8; to men with severe acute urticaria – with a Df value close to 177.4; to men suffering from mild chronic urticaria – with a Df value close to 160.0; to men with severe chronic urticaria – with a Df value close to 166.8:

– Df (for men with mild acute urticaria) =- the bone component of body mass according to Matiegka×6.850 + shoulder width×10.05 - 178.8;

– Df (for men with severe acute urticaria) =- the bone component of body mass according to Matiegka×5.440 + shoulder width×9.645 - 177.4;

– Df (for men with mild chronic urticaria) =- the bone component of body mass according to Matiegka×5.454 + shoulder width×9.237 - 160.0;

– Df (for men with severe chronic urticaria) =- the bone component of body mass according to Matiegka×6.317 + shoulder width×9.633 - 166.8.

Using the $\chi 2$ criterion, the statistical significance of all discriminant functions was determined (Table 2). From the results of the determined Df indices and given in Table 2, it can be seen that, taking into account the indices of body structure and size, a reliable interpretation of the obtained classification indices is possible only between men with acute and chronic urticaria.

Table 2

Step-by-step analysis report including the χ^2 criterion for all canonical roots in male urticaria patients taking into account parameters of body structure and size

	Eigen-value	Canonicl R	Wilks' Lambda	Chi-Sqr.	df	p-level
0	0.370	0.520	0.620	17.20	6	0.0086
1	0.176	0.387	0.850	5.851	2	0.0537

Thus, when analyzing the discriminant equations obtained by us, it was established that in men a reliable ($p<0.001$) interpretation of the obtained classification indices is possible only between practically healthy and patients with urticaria (Wilks' Lambda statistic=0.113). The composition of these models includes the ST (25.0 %), the transverse dimensions of the trunk and pelvis (37.5 %), the width of the distal epiphysis of the lower leg, the endomorphic component of the somatotype, and the muscle component of body mass according to Matiegka (12.5 % each). ST on the side and the intertrochanteric distance of the pelvis have the greatest contribution to the discrimination between healthy and urticaria-afflicted men. An even percentage of entry into the discriminant models of transverse body dimensions, which are highly genetically determined, as well as the ST, the endomorphic component of the somatotype, and the muscle component of the body mass, which are low genetically determined [1], indicate a genetic predisposition, as well as the influence of external factors on the occurrence of this multifactorial disease.

When dividing Ukrainian men only into acute and chronic urticaria of a mild and severe course, it was established that, taking into account anthropo-somatotypological indices, a reliable ($p<0.01$) interpretation of the obtained classification indices is possible only between patients with acute and chronic urticaria (Wilks' statistic Lambda=0.620). The composition of these models includes the bone component of body mass according to Matiegka (makes the largest contribution to discrimination) and shoulder width (50.0 % each), which are highly genetically determined indices [1].

The fact of the existence of a strong connection between human skin and other parameters of the human body and even organ systems and psychological features is proven. One of these examples is the presence of interdependence between indices of personality characteristics and features of the comb pattern of human skin [11]. Considering the strength of the connection and at the same time, at first glance, the remoteness of the investigated systems, the discovery of a connection between the risk of skin diseases and somatotypological indices does not cause any surprise.

One of the common skin diseases, for which the existence of such a connection has been reliably proven, is eczema. A group of Ukrainian researchers [2] investigated the peculiarities of ST indices in men with various forms of eczema. Compared to healthy individuals, patients had lower ST values on the back and front of the shoulder, forearm, chest, thigh, and lower leg. At the same time, the authors revealed several trends regarding the different values of ST in people with different forms of severity of the disease.

Another common skin disease is psoriasis. Regarding it, there are also reliable data that testify to the existence of its connection with certain anthropometric indices. A meta-analysis of publications revealed that an increase in BMI by 5 units increased the total risk of psoriasis by 1.19; an increase in waist circumference by 10 cm by 1.24, and an increase in the ratio of waist circumference to hips by 0.1 – by 1.37, and an increase in weight by 5 kg – by 1.11 [3].

In another study related to psoriasis, a 12-year follow-up of more than 67,000 women was performed. 809 of them developed psoriasis during this observation period. The authors of the study found a positive relationship with BMI ($p<0.0001$). Larger values of waist circumference, hip circumference, and waist-to-hip ratio were also associated with a higher risk of psoriasis, but became less significant after adjustment for BMI [7].

A similar kind of research was carried out on such a disease as rosacea. Almost 90,000 participants took part in it and were followed from 1991 to 2005. During these 14 years of observation, 5,249 people developed rosacea. After statistical data processing, an increased risk of the occurrence of this pathology was revealed in persons with high BMI values ($p<0.0001$) and high waist-to-hip ratio values ($p<0.0001$). Unlike the previous study, this relationship remained significant even after adjusting for BMI [8].

Currently, there is a limited number of publications in the world literature dedicated to finding the relationship between somatotypological indices and the risk of urticaria. Kim Y. H. [6] with co-authors revealed the existence of a relationship between the risk of urticaria and many anthropometric indices. In

particular, it was established that with an increase in waist circumference and BMI, the risk of this pathology increases. In addition, the waist circumference index is prognostic for predicting the duration of urticaria.

In another study performed on a Turkish population, no reliable relationship between anthropometric parameters and the risk of urticaria was found. At the same time, the authors found reliable connections between this pathology and such laboratory indices as the number of neutrophils and the value of C-reactive protein ($p=0.008$ and $p=0.024$, respectively) [9].

In general, scientists tend to believe that such pathologies as metabolic syndrome and obesity play a key role in the pathogenesis of urticaria, which in turn makes anthropometric indices important markers that should be taken into account [14].

Conclusions

1. Reliable discriminant models developed on the basis of anthropometric and somatotypological indices allow predicting the possibility of urticaria in Ukrainian men (correctness 83.6 %, Wilks' Lambda statistic=0.113; $p<0.001$). A reliable interpretation of the obtained classification indices is possible only between practically healthy and sick men. The built models most often include the transverse dimensions of the torso and pelvis (37.5 %) and SF (25.0 %).

2. Only in Ukrainian men suffering from urticaria, reliable discriminant models (correctness 60.0 %, Wilks' Lambda statistic=0.620; $p<0.01$) allow predicting only the form of the disease (acute or chronic). The built models include the bone component of body weight and shoulder width (50.0 % each).

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