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MODELING, USING REGRESSION ANALYSIS, HEART RATE VARIABILITY DEPENDING ON THE CHARACTERISTICS ANTHROPO-SOMATIC INDICES IN HEALTHY GIRLS WITH HYPERKINETIC TYPE OF HEMODYNAMICS

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In practically healthy girls of Podillia with a hyperkinetic hemodynamic type, using regression analysis, all 17 individual models of heart rate variability (HRV) parameters were constructed depending on the peculiarities of the constitutional parameters of body, age and brush compression forces with determination coefficients R2 greater than 0.7 (the determination coefficient R2 determines the admissible dependent variable in the group of statistical indicators of HRV from 81.0% to 95.7%; in the group of parameters of variation pulsometry - from 79.5% to 91.7%; in the indicator group vegetative homeostasis by Baevsky method - from 76.6% to 89.8%; in group of the spectral index of HRV - from 79.5% to 86.2%). The most commonly models of HRV included the width of distal epiphyses of long tubular limb bones (23.5%, mostly lower limb), brushing force (17.6%, uniformly on both hands), circumferential body dimensions (12.2%, predominantly by the expense of limbs) and age (11.8%).

Key words: indicators of heart rate variability, anthropological parameters, practically healthy girls, regression models.

The researches carried out in recent years [11, 19, 21] give grounds to consider that the features of autonomic regulation of the cardiovascular system are one of the most important factors in the formation of the type of human circulation. Currently, the analysis of cardiac rhythm variability is one of the methods for assessing the system of neurohumoral regulation of blood circulation. In this case, the heart rate reflects the end result of numerous regulatory influences on the cardiovascular system and contributes to the amount of blood pressure as an integral index of hemodynamics. Individual typological peculiarities of the regulation of systemic hemodynamics, based on the role of the cardiovascular component in maintaining hemodynamic homeostasis, determine the variability of blood circulation indices in practically healthy individuals in the state of functional rest [12, 13]. Complex researches on the determination of the state of the autonomic nervous system and the influence of hemodynamic types on various components of the vegetative state (stress indices and vegetative reactivity) in the juvenile age under consideration, taking into account anthropometric indices, were not carried out.

The purpose of the study is to construct and analyze the regression models of individual indicators of HRV, depending on the anthropo-somatometric parameters of the body, age and force of compression of the hands in practically healthy girls of Podillya with a hyperkinetic type of hemodynamics.

Material and methods. We conducted complex clinical-laboratory, psychohygienic, psychophysiological and anthropogenic examination of young urban population of the Podillia region of Ukraine at the Research Center of National Pirogov Memorial Medical University, Vinnitsa. As a result, we enrolled 129 healthy 16-20 year-old young women according to the age periodization of human ontogenesis, adopted by VII All-Union Conference on the Problems of Age Morphology, Physiology and Biochemistry of the Academy of Pedagogical Sciences of the USSR in 1965. To determine the type of hemodynamics, young men and women were subjected to a 15-second tetrapolar thoracic rheogram synchronized with phonocardiography and electrocardiogram. The type of blood circulation was determined against the heart index values [20]. 19 young women with hyperkinetic hemodynamics type recorded rhythmograms during 5 minutes in the progress of electrocardiography in the second standard lead followed by computer processing of the results. In parallel with the electrocardiography, a pneumogram was recorded using a nasal thermistor. The cardiac rhythm data were analyzed using a computer program of a certified cardiological diagnostic complex [10]. The variational pulsometry, statistical and spectral HRV indicators were evaluated according to the recommendations of the European and North American Cardiology Association (1996) against the results of processing the obtained results. We assessed the following parameters of variational pulsometry (VP): the mode (Mo, ms) - a value of the most common R-R interval (corresponds to a maximum histogram); a mode amplitude (AMo,%) – a number of R-R intervals corresponding to the mode value represented in % of the sample size; average R-R interval (NNM, ms); minimum R-R interval (Min, ms) (abnormal R-R intervals were excluded); maximum R-R interval (Max, ms) (abnormal R-R intervals were excluded); variation range (VR, ms), calculated as a difference between Max and Min values.

Among the HRV statistical indicators the following were determined: the standard deviation of the length of normal R-R intervals (SDNN, ms); square root of the sum of squares of the differences of the values of successive pairs of normal R-R intervals (RMSSD, ms); and the percentage of a number of pairs of successive normal R-R intervals that differ from the total number of pairs of consecutive intervals by more than 50 ms (PNN50, %). Using the appropriate formulas, we calculated the indicators of autonomic homeostasis (AH) by Baevsky method, namely: vegetative equilibrium index (IVR = AMO/VR); the index of regulatory systems tension (IN = AMo/(2 x VR x Mo)); and vegetative rhythm indicator (VPR = 1/(Mo x VR)). During the HRV spectral analysis, we defined the following frequency ranges: very low frequency (VLF, 0.003-0.04 Hz), low frequency (LF, 0.04-0.15 Hz) and high frequency (HF, 0.15-0.4 Hz) ranges. For each range, we determined both the signal strength and the contribution of each oscillatory component to the total power of spectrum (FO). We considered the power ratio in the low and high frequency bands (LF/HF).

The anthropometric examination of young men was conducted in accordance with the V. Bunak scheme [1]. The antropometric somatotype was defined using J. Carter and B. Heath method [2]. The component body weight was determined according to the methodology by J. Matiegka [9]. The strength of right and left hands was measured with the help of a dynamometer.

The construction of regression models of individual HRV indices, depending on the characteristics of anthropo-somatotypological indicators, age and brush compression forces in girls with hyperkinetic hemodynamics type, was conducted in the statistical package "STATISTICA 5.5".

Results and its discussion. Models of individual indicators of HRV, depending on the characteristics of anthropo-somatotypological indicators, age and brush compression forces in virtually healthy girls with hyperkinetic hemodynamic type with determination coefficient R2 greater than 0.7, have the form of the following linear equations: SDNN= 114,6 – 6,712 × brush circumference + 11,59 × the circumference of the shin in the lower third – 9,689 × inter-swivel size pelvis + 1,417 × length of the body – 18,99 × width of distal epiphysis (WDE) of shin (R2= 0,810); PNN50= 309,9 + 7,358 × the thickness of the skin-fat folds (TSFF) on the side – 4,967 × brush circumference – 6,809 × transverse lower-thoracic size – 20,19 × WDE of shoulder + 3,834 × the circumference of the shin in the upper third – 1,218 × the circumference of the hips (R2= 0,895); RMSSD = 68,72 + 3,717 × TSFF on the side – 2,187 × compression strength of right hand + 3,094 × the forearm's girth in the upper third + 3,260 × length of the body – 4,356 × fingertip height – 12,94 × WDE of shin (R2= 0,957); Mo = -0,561 + 0,103 × sagittal size of the chest – 0,056 × TSFF on the shin + 0,015 × compression strength of left hand – 0,112 × WDE of shoulder + 0,009 × waist circumference (R2= 0,806); AMo = 38,23 – 3,480 × the circumference of the shin in the lower third + 5,409 × neck circumference – 2,833 × TSFF on the back of the shoulder – 2,137 × intergranular size of the pelvis – 7,732 × WDE of shin + 2,053 × brush circumference (R2= 0,917); NNM = -1,025 + 0,096 × sagittal size of the chest – 0,059 × TSFF on the shin + 0,015 × compression strength of left hand – 0,105 × WDE of shin + 0,016 × waist circumference + 0,026 × ectomorphic component of the somatotype (R2= 0,865); Max = 0,019 + 0,015 × the height of the spin point – 0,021 × fingertip height + 0,028 × length of the body – 0,035 × height of shoulder point + 0,021 height of the pubic point – 0,142 × WDE of shin + 0,017 × the forearm's girth in the upper third (R2= 0,879); Min = -1,171 + 0,099 × sagittal size of the chest + 0,036 × compression strength of left hand – 0,046 × TSFF on the shin – 0,033 × the forearm's girth in the upper third – 0,017 × compression strength of right hand + 0,025 × the circumference of the shin in the upper third (R2= 0,821); VR = -0,327 – 0,075 × bone mass of the body іла + 0,076 × the circumference of the shin in the lower third – 0,029 × mesomorphic component of the somatotype + 0,038 × girth of the chest on the inspiration – 0,036 × girth of the chest in a calm condition – 0,036 × external conjugate (R2= 0,795); IVR = -271,0 – 22,30 × the circumference of the shin in the lower third + 18,76 × neck circumference – 29,36 × endomorphic component of the somatotype + 68,95 × WDE of forearm (R2= 0,787); VPR = -15,37 + 4,615 × WDE of forearm – 0,301 × TSFF on the side – 0,370 × the circumference of the shin in the lower third – 0,075 × compression strength of right hand + 0,329 × the circumference of the hips – 0,313 × muscle mass for Matiegka (R2= 0,898); IN = -46,40 – 12,39 × the circumference of the shin in the lower third + 13,20 × bone mass of the body + 12,23 × transverse middle-thoracic size – 12,31 × endomorphic component of the somatotype (R2= 0,766); FO = 15811 – 1503 × brush circumference + 2588 × the circumference of the shin in the lower third – 2067 × inter-swivel size pelvis + 311,8 × length of the body – 8150 × WDE of thighs + 3899 × WDE of shin (R2= 0,860); VLF = -1486 + 878,8 × the forearm's girth in the upper third – 2074 × WDE of thigh – 1248 × WDE of shoulder – 330,1 × the circumference of the hips + 757,2 × the circumference of the shin in the lower third + 122,0 × fingertip height (R2= 0,821); LF = 4355 – 1700 × WDE of forearm + 455,6 × the circumference of the shin in the lower third – 464,2 × the forearm's girth in the lower third + 218,5 × shoulder width – 394,8 × TSFF on the chest – 261,0 × age + 194,8 × TSFF on the shin (R2= 0,821); HF = 19839 + 773,7 × the circumference of the shin in the lower third – 1216 × WDE of thighs – 278,5 × the height of the spin point – 213,9 × TSFF on the side – 795,6 × mesomorphic component of the somatotype (R2= 0,795); LF/HF = -4,606 + 1,031 × WDE of shin – 0,528 ×

age + 0,056 × girth of the chest on exhalation – 0,216 × TSFF on the chest + 0,212 × inter-ovate size of the pelvis ($R2$= 0,862). Thus, in girls with a hyperkinetic hemodynamic type, reliable models were constructed for all 17 indicators of HRV that were studied; the determination coefficients for R2 in these models ranged from 0.766 to 0.957. Determination coefficient R2 determines admissible dependent variable in the group of statistical indicators of HRV - from 81.0% to 95.7%; in the VP group - from 79.5% to 91.7%; in the group of indicators of HV by Baevsky method - from 76.6% to 89.8%; in the group of spectral indices of HRV - from 79.5% to 86.2%. The most commonly used models included the following predictors: in the general group of indicators, HRV - WDE (23.5%, mainly lower limb), the force of brush compression (17.6%, uniformly on both hands), the circumferential dimensions of the body (12.2%, mainly due to limbs) and age (11.8%); separately among the statistical indices of HRV - WDE (25,0%), total body dimensions (22,2%), brush compression force (16,7%) and circumferential body dimensions (13,3%); separately among the indicators of the VP - the force of brush compression (33.3%), WDE (16.7%), longitudinal body dimensions (13.3%), circumferential body dimensions (12.2%), components of somatotype (11.1%) and body diameters (10.4%); separately among the indicators of VH according to the Baevsky method are components of the somatotype and components of the body composition (22.2%), WDE and the force of brush compression (by 16.7%) and the circumferential body dimensions (11.1%); separately among the spectral indices of HRV - age (40.0%), WDE (35.0%) and girths of the body (12.0%). Among the individual indicators, the most commonly used models are the coat of the shin in the lower third (10.8%), WDE of thighs (by 6.5%) and WDE of shin (5.4%). Not included in the models as predictors the following groups of indicators - in the general group of indicators of HRV - are absent; separately among the statistical indicators of HRV are components of the somatotype, indicators of the component composition of body weight and age; separately among the indicators of the VP - only age; separately among the indicators of VH according to the Baevsky method - total and longitudinal dimensions of the body and age; separately among the spectral indices of the HRV are indicators of the component composition of the body mass and the force of brush compression.

It is known that hypo- and hyperkinetic types of hemodynamics are extreme variants of the norm in which the value of individual functional parameters increases or decreases, which results in selective sensitivity in relation to a certain type of neurohumoral effects [3, 5, 18]. Therefore, it is quite expected to construct reliable models of HRV indices with a determination coefficient of more than 0.5 precisely in the representatives of extreme hemodynamic types. In our research, the determination coefficients of R2 of the corresponding HRV indices in all models of girls with hyperkinetic hemodynamic type were larger (often much larger) than in virtually healthy girls with hypo- (R2 from 0.504 to 0.798) [7] and, in particular, from eukinetic (R2 was only 0.095 to 0.342) [17] types of hemodynamics.

In order to determine the regional criteria for the division of the studied types of hemodynamics, according to a number of domestic scientists, in addition to sexual differences, age, height and weight, other parameters that characterize physical development (WDE of extremities, body diameters, strength of the body, proportions of development of individual parts of the body, the degree of development of functional abilities (life capacity of the lungs, muscle strength of hands, etc., muscle development and muscle tone, posture, musculoskeletal system, development of subcutaneous fat layer, turgor of skin)) [4, 6, 8, 14, 15, 16]. So in our studies [7, 17], the most commonly used models for girls with different types of hemodynamics when assessing the general group of HRV indices were the indexes of the WDE of the limbs (from 11.8 to 23.5%) and, except for girls with a hypokinetic type hemodynamics, - age (from 11,8 to 35,3%) and the force of brush compression (from 11,8 to 17,6%); at the estimation of the statistical indicators of HRV - except for girls with eukinetic type of hemodynamics, WDE of limbs and total body sizes (25.0% to 37.5% and 16.7% to 22.2%, respectively), except for girls with hypokinetic hemodynamic type of circumcision body size (13.3%), and with the exception of girls with hyperkinetic hemodynamics, the components of the body weight (from 11.1 to 16.7%); when evaluating the parameters of the VP - the diameters of the body (from 10.4 to 16.7%); when evaluating the parameters of VH according to the Baevsky method - the components of the body composition (from 11.1 to 22.2%), with the exception of girls with a hypokinetic type of hemodynamics, the force of brush compression (from 16.7 to 50.0%) and WDE of the limbs (by 16.7%), and with the exception of girls with eukinetic type hemodynamics, the components of the somatotype (from 11.1 to 22.2%); at the estimation of the spectral indices of the HRV - WDE of the limbs and the circumferential dimensions of the body (20.0% to 35.0% and 10.7% to 15.0% respectively), and, with the exception of girls with a hyperkinetic hemodynamic type, longitudinal body sizes (from 10.0 to 20.0%) [7, 17].

Conclusion

1. In girls with a hyperkinetic hemodynamic type constructed reliable models for all 17 HRV parameters studied with a determination coefficient R2 from 0.766 to 0.957. In the statistical indicator group HRV, determination coefficient R2 determines the admissible variable from 81.0% to 95.7%; in the VP group - from

79.5% to 91.7%; in the group of indicators of VH by Baevsky method - from 76.6% to 89.8%; in the group of spectral indexes of HRV - from 79.5% to 86.2%.
2. The most commonly used models of HRV indices WDE (23.5%, predominantly lower limb), brushing force (17.6%, uniformly on both hands), circumferential body dimensions (12.2%, mainly due to limbs) and age (11.8%).
3. Among the individual groups of indicators, HRV most often included models: to the statistical indices of HRV - WDE (25.0%), total body dimensions (22.2%), brushing force (16.7%), and circumferential body dimensions (13.3%); to the indicators of VP - the force of brush compression (33.3%), WDE (16.7%), longitudinal dimensions of the body (13.3%), circumferential body dimensions (12.2%), somatotype components (11.1%) and diameters of the body (10.4%); to the indicators of VH by Baevsky method - the components of the somatotype and the components of the body composition (22.2%), and the compressive strength of the brushes (by 16.7%) and the circumferential body dimensions (11.1%); to the spectral indices of HRV - age (40.0%), WDE (35.0%) and the circumferential dimensions of the body (12.0%).

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Реферати

МОДЕЛЮВАННЯ, ЗА ДОПОМОГОЮ РЕГРЕСІЙНОГО АНАЛІЗУ, ПОКАЗНИКІВ ВАРІАБЕЛЬНОСТІ СЕРЦЕВОГО РИТМУ В ЗАЛЕЖНОСТІ ВІД ОСОБЛИВОСТЕЙ АНТРОПО-СОМАТОТИПОЛОГІЧНИХ ПОКАЗНИКІВ ЗДОРОВИХ ДІВЧАТ З ГІПЕРКІНЕТИЧНИМ ТИПОМ ГЕМОДИНАМІКИ

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У практично здорових дівчат Поділля з гіперкінетичним типом гемодинаміки, за допомогою регресійного аналізу,

МОДЕЛИРОВАНИЕ, С ПОМОЩЬЮ РНГРЕССИОН-НОГО АНАЛИЗА, ПОКАЗАТЕЛЕЙ ВАРИАБЕЛЬ-НОСТИ СЕРДЕЧНОГО РИТМА В ЗАВИСИМОСТИ ОТ ОСОБЕННОСТЕЙ АНТРОПО-СОМАТОТИПО-ЛОГИЧЕСКИХ ПОКАЗАТЕЛЕЙ ЗДОРОВЫХ ДЕВУШЕК С ГИПЕРКИНЕТИЧЕСКИМ ТИПОМ ГЕМОДИНАМИКИ

Сергета И. В., Ковальчук В. В., Дмитренко С. В., Семененко А. И., Очеретная О. Л., Перебетюк Л. С., Прокопенко С. В.

У практически здоровых девушек Подолья с гиперкинетическим типом гемодинамики, с помощью побудовані усі 17 можливих індивідуальних моделей показників варіабельності серцевого ритму (ВСР) в залежності від особливостей конституціональних параметрів тіла, віку та сили стискання кистей з коефіцієнтами детермінації R2 більшими 0,7 (коефіцієнт детермінації R2 обумовлює допустимо залежну змінну в групі статистичних показників ВСР від 81,0 % до 95,7 %; в групі показників варіаційної пульсометрії – від 79,5 % до 91,7 %; в групі показників вегетативного гомеостазу за методом Баєвського – від 76,6 % до 89,8 %; в групі спектральних показників ВСР – від 79,5 % до 86,2 %). Найбільш часто до моделей показників ВСР входять ширина дистальних епіфізів довгих трубчастих кісток кінцівок (23,5 %, переважно нижньої кінцівки), сила стискання кистей (17,6 %, рівномірно на обох кистях), обхватні розміри тіла (12,2 %, переважно за рахунок кінцівок) і вік (11,8 %).

Ключові слова: показники варіабельності серцевого ритму, антропологічні показники, практично здорові дівчата, регресійні моделі.

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регрессионного анализа, построены все 17 возможных индивидуальных модели показателей вариабельности сердечного ритма (ВСР) в зависимости от особенностей конституциональных параметров тела, возраста и силы сжатия кистей с коэффициентами детерминации R2 большими 0,7 (коэффициент детерминации R2 обуславливает допустимо зависимую переменную в группе статистических показателей ВСР от 81,0 % до 95,7 %; в группе показателей вариационной пульсометрии – от 79,5 % до 91,7 %; в группе показателей вегетативного гомеостаза за методом Баевского – от 76,6 % до 89,8 %; в группе спектральных показателей ВСР – от 79,5 % до 86,2 %). Наиболее часто в модели показателей ВСР входят ширина дистальных эпифизов длинных трубчатых костей конечностей (23,5 %, преимущественно нижней конечности), сила сжатия кистей (17,6 %, равномерно на обеих кистях), обхватные размеры тела (12,2 %, преимущественно за счет конечностей) и возраст (11,8 %).

Ключевые слова: показатели вариабельности сердечного ритма, антропологические показатели, практически здоровые девушки, регрессионные модели.

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THE ROLE OF MICROBIAL COMPONENT IN THE PROGRESSION OF THE ACUTE SUPPURATIVE INFLAMMATION OF TISSUES OF MAXILLOFACIAL AREA IN CHILDREN

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The paper presents the generalization of the experience acquired at the clinic of the Department of Children's Oral Surgery and Propedeutics of Oral Surgery at Ukrainian Medical Stomatological Academy, which refers to the study of the role of microbial factor in the etiology, pathogenesis and clinical course of the acute odontogenic and nonodontogenic inflammatory processes in the maxillofacial area in 896 children with lymphadenitis, adenophlegmon and odontogenic osteomyelitis. The comparison of our own achievements and scientific studies, presented in publications, indicate about the urgent need in further routine study of the issue taking into account the possibilities of involving the state-of-the-art technical achievements and developments made in the field of microbiology.

Key words: children, inflammatory process, odontogenic lymphadenitis, osteomyelitis, maxillofacial area.

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Among the key factors that lead to increase in number of children with inflammatory processes of the oral cavity and maxillofacial area, the most significant are [1, 3, 9].

Socio-biological: health disturbances in the vast majority of pregnant women during pregnancy; low level of awareness of parents, relatives and children with regard to dental morbidity; prevalence of artificial and mixed feeding of babies and the acute infections and general somatic diseases in the history; low level of physical development of the child. Socio-hygienic: unsatisfactory hygiene of the oral cavity and low efficacy of the sanitary-educational activities, poor effectiveness of dental preventive measures, delayed ask of parents for medical aid and non-fulfillment of doctors' recommendations. Purely social: outdated dental armamentarium or lack of effective treatment and preventive programs concerning the target groups of population (both pregnant women and children), impoverishing of the fellow citizens.

The purpose of paper was the study of generalization and comparison of our own observations and publication data regarding the role of microbial factor in the onset and clinical course of the acute nonspecific inflammatory processes in the maxillofacial area in children.

Method and material. We have analyzed the results of the comprehensive 10 year long examination of 896 children with acute inflammatory processes of maxillofacial area of both odontogenic and nonodontogenic origin. All children received treatment at the Surgical Unit of Poltava Children's Municipal Clinical Hospital, affiliated to the Department of Children's Oral Surgery at HSEEU "Ukrainian Medical Stomatological Academy". Special consideration has been given to the findings of the microbiological and serological examinations, reported in the histories of patients with lymphadenitis (420 cases (46.9%)), adenophlegmon (26 cases (29.1%)) and acute odontogenic osteomyelitis (215 cases (24.0%)). Bacteriological