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NEUROVEGETATIVE REGULATION OF THE CARDIORESPIRATORY FUNCTIONAL SYSTEM IN PATIENTS WITH BRONCHIAL ASTHMA

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Abstract: This study evaluated neurovegetative regulation of the cardiorespiratory functional system in patients with bronchial asthma. The study included 32 patients with bronchial asthma and 25 healthy individuals. Heart rate variability was analyzed using five-minute recordings obtained after standardized rest, with assessment of total, very-low-, low-, and high-frequency spectral components. Patients with bronchial asthma demonstrated significantly reduced total spectral power and VLF, LF, and HF components compared with healthy individuals, while LF/HF increased from 1.52±0.11 to 2.14±0.14. The findings indicate a shift toward sympathetic predominance and reduced adaptive capacity of autonomic cardiovascular regulation in bronchial asthma.

Keywords: bronchial asthma; heart rate variability; neurovegetative regulation; cardiorespiratory system; sympathetic predominance.

НЕЙРОВЕГЕТАТИВНАЯ РЕГУЛЯЦИЯ КАРДИОРЕСПИРАТОРНОЙ ФУНКЦИОНАЛЬНОЙ СИСТЕМЫ У БОЛЬНЫХ БРОНХИАЛЬНОЙ АСТМОЙ

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Аннотация: В исследовании оценивалась нейровегетативная регуляция кардиореспираторной функциональной системы у больных бронхиальной астмой. Обследованы 32 пациентов с бронхиальной астмой и 25 здоровых лиц. Вариабельность сердечного ритма анализировали по пятиминутным записям после стандартизированного периода отдыха с оценкой общей

мощности спектра и компонентов VLF, LF и HF. У больных бронхиальной астмой выявлено достоверное снижение общей мощности спектра, а также VLF, LF и HF по сравнению со здоровыми лицами, при этом LF/HF увеличивался с 1,52±0,11 до 2,14±0,14. Полученные данные свидетельствуют о смещении симпатовагусного баланса в сторону симпатикотонии и снижении адаптационных возможностей вегетативной регуляции сердечно-сосудистой системы при бронхиальной астме.
Ключевые слова: бронхиальная астма; вариабельность сердечного ритма; нейровегетативная регуляция; кардиореспираторная система; симпатикотония.
Introduction: Bronchial asthma is a chronic inflammatory respiratory disorder in which pathological changes are not limited to the bronchial tree but may influence the functional interaction between respiratory and cardiovascular systems. Autonomic regulation has an important role in maintaining cardiovascular adaptation to physiological and pathological stimuli. Heart rate variability is a noninvasive indicator that reflects the activity of different regulatory levels controlling cardiac rhythm. Changes in its spectral characteristics may indicate altered sympathetic, parasympathetic, subcortical, and central regulatory mechanisms. In patients with bronchial asthma, persistent inflammation and changes in respiratory function can modify autonomic balance and reduce the adaptive capacity of the organism. Assessment of the total spectral power and VLF, LF, and HF components allows quantitative characterization of these changes. The LF/HF ratio provides additional information about sympathovagal balance, while the centralization index reflects the relationship between central and autonomic regulatory mechanisms. Previous observations demonstrated that patients with asthma have lower heart rate variability than healthy individuals, with the most pronounced reduction involving the parasympathetic component. At the same time, increased sympathetic predominance may develop as disease severity and inflammatory activity increase. Age and sex may also influence the autonomic

profile. Therefore, assessment of neurovegetative regulation may provide additional functional information about bronchial asthma and its systemic effects. Characterizing these changes may contribute to earlier recognition of impaired adaptation and improve understanding of the cardiorespiratory mechanisms accompanying asthma.

Aim of the study: To assess the characteristics of neurovegetative regulation of the cardiorespiratory functional system in patients with bronchial asthma by analyzing heart rate variability and its spectral components in comparison with healthy individuals.

Materials and methods. The study included 57 participants aged 15–65 years. The main group consisted of 32 patients with bronchial asthma, including 15 men and 17 women, with a mean age of 32.1±0.79 years and mean disease duration of 9.56±0.48 years. Patients had mild (49%) or moderate (51%) asthma and were examined during remission (52%) or subsiding exacerbation (48%). The control group comprised 250 healthy individuals, including 11 men and 14 women, with a mean age of 26.9±0.5 years. Heart rate variability was investigated using the Spiroarteriocardiorhythmograph “SAKR-2”. Five-minute recordings were obtained in the morning after 15 minutes of rest. Participants had not taken medications for six hours and had not smoked before examination. Spectral analysis included total power (TP), very-low-frequency power (VLF, 0.03–0.05 Hz), low-frequency power (LF, 0.05–0.15 Hz), and high-frequency power (HF, 0.15–0.40 Hz). The LF/HF ratio was used to characterize sympathovagal balance, while the centralization index reflected the relationship between central and autonomic regulatory mechanisms. Statistical analysis included parametric and nonparametric methods. Differences between two groups were assessed using Student’s t-test, and Pearson correlation analysis was used to evaluate linear associations. Statistical calculations were performed with Statistics for Windows 5.0, Statgraphics 7.0, and related software. A significance level of $p<0.05$ was accepted.

Results. Patients with bronchial asthma demonstrated a significant reduction in heart rate variability compared with healthy individuals across the principal frequency ranges. Total spectral power decreased from 3761.98±360.12 to 2311.82±156.05 ms² (t=4.11; p=0.001). VLF power decreased from 766.77±48.66 to 588.47±30.89 ms² (t=3.22; p=0.001), while LF decreased from 1161.62±91.04 to 832.53±79.43 ms² (t=2.73; p=0.007). The most pronounced reduction was observed in HF power, which fell from 1495.52±169.96 to 812.84±70.93 ms² (t=4.01; p=0.001), representing a 45.6% decrease and indicating substantial reduction of vagal influence. The LF/HF ratio increased from 1.52±0.11 in healthy participants to 2.14±0.14 in asthma (t=3.40; p=0.001), demonstrating a shift toward sympathetic predominance. Mean heart rate increased from 71±0.72 to 77±0.68 beats/min (t=5.91; p=0.001). The centralization index also increased from 2.74±0.17 to 5.02±0.42 (t=4.61; p=0.001), indicating greater involvement of higher regulatory levels. SNCA did not differ significantly between groups. Correlation analysis demonstrated different relationships among variability parameters in healthy individuals and patients with asthma. In asthma, associations between LF and the centralization index were absent, whereas relationships between segmental and subcortical mechanisms remained. Disease severity was inversely associated with TP (r=-0.22), VLF (r=-0.22), LF (r=-0.19), and HF (r=-0.12; p=0.001). During exacerbation, TP, VLF, LF, and HF decreased, whereas LF/HF and centralization index increased (p<0.04). Age was associated with decreasing TP, VLF, LF, HF, and SNCA and increasing LF/HF and centralization index.

Conclusions: Bronchial asthma is accompanied by significant impairment of neurovegetative cardiac regulation. Patients demonstrated reduced total spectral power and lower VLF, LF, and HF components, with the greatest reduction in the parasympathetic HF range. LF/HF increased from 1.52±0.11 to 2.14±0.14, indicating sympathetic predominance, while heart rate increased from 71±0.72 to 77±0.68 beats/min. Increasing disease severity and inflammatory activity were associated with further reduction of heart rate variability. These findings indicate

reduced adaptive capacity and an important role of autonomic dysregulation in the cardiorespiratory functional changes associated with bronchial asthma.

References.

1. Ziyadullaev, S. K., Sultonov, I. I., Dushanova, G. A., & Akbarovna, K. S. (2021). The Effectiveness Of Pharmacotherapy For Dmards With Ra Depending On The C3435t Polymorphism Of The Mdr1 Gene. *Int. J. of Aquatic Science*, *12*(3), 2908-2916.
2. Islomovich, S. I. (2024). GENDER CHARACTERISTICS OF THE CURRENT RHEUMATOID ARTHRITIS. *International journal of medical sciences*, *4*(10), 3-8.
3. Ilkhom, S. (2023). CAJAM–VOLUME 1. ISSUE 1. 2023. *Central Asian Journal of Advanced Medicine*, *1*(01), 16-19.
4. Kireev, V. V., Sultonov, I. I., Ziyadulaaev, S. K., Suyarov, A. A., Aripova, T. U., Usmanbekova, K. T., & Nasretdinova, M. T. (2021). Genetic Engineered Preparations-An Innovative Approach in the Treatment of Rheumatoid Arthritis. *Annals of the Romanian Society for Cell Biology*, *25*(3), 4114-4119.
5. Sultonov, I. I., Xasanov, F. S., Eshmuratov, S., Uralov, R. S., Shukurova, D., & Ziyadullayev, S. X. Predictors of Systemic Lupus Erythematosus: A Case-control Study. *International journal of health sciences*, *6*(S10), 175-182.
6. Khusainova, M. A., Vakhidov, J. J., Khayitov, S. M., & Mamadiyorova, M. M. (2023). Cardiac arrhythmias in patients with rheumatoid arthritis. *Science and Education*, *4*(2), 130-137.
7. Yarmatov, S., Khusainova, M., & Djabbarova, N. (2023). STUDY OF QUALITY OF LIFE INDICATORS IN PATIENTS WITH CORONARY HEART DISEASE USING THE SF-36 QUESTIONNAIRE. *Бюллетень студентов нового Узбекистана*, *1*(7), 58-64.