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HEART RATE VARIABILITY IN PATIENTS WITH COMORBID HAY FEVER AND ATHEROSCLEROTIC HEART DISEASE DURING ALLERGEN POLLINATION

**Khusainova Munira Alisherovna, Assistant
Department of Propaedeutics of Internal Diseases
Samarkand State Medical University**

Abstract: This study evaluated heart rate variability in patients with comorbid hay fever and atherosclerotic heart disease during exposure to significant pollen allergens. 60 participants aged 35–60 years were divided into 20 patients with both conditions, 30 with cardiovascular disease without hay fever, and 10 controls. Holter electrocardiography and ambulatory blood pressure monitoring were performed during pollen exposure and remission. During exacerbation, heart rate, systolic and diastolic blood pressure increased, while heart rate variability indicated sympathetic predominance. These findings demonstrate enhanced sympathetic and humoral-metabolic regulation during pollen-induced exacerbation in cardiovascular comorbidity.

Keywords: heart rate variability; hay fever; atherosclerotic heart disease; sympathetic regulation; pollen exposure.

ВАРИАБЕЛЬНОСТЬ СЕРДЕЧНОГО РИТМА У ПАЦИЕНТОВ С КОМОРБИДНЫМ ПОЛЛИНОЗОМ И АТЕРОСКЛЕРОТИЧЕСКОЙ БОЛЕЗНЬЮ СЕРДЦА В ПЕРИОД ПОЛЛИНАЦИИ ПРИЧИННО-ЗНАЧИМОГО АЛЛЕРГЕНА

**Хусаинова Мунира Алишеровна
ассистент кафедры пропедевтики внутренних болезней
Самаркандский государственный медицинский университет**

Аннотация: В исследовании оценивали вариабельность сердечного ритма у пациентов с коморбидным поллинозом и атеросклеротической болезнью сердца в период воздействия причинно-значимого аллергена. Обследованы 60 пациентов 35–60 лет: 20 с сочетанной патологией, 30 с сердечно-

сосудистыми заболеваниями без поллиноза и 10 здоровых лиц. Проводили суточное холтеровское мониторирование ЭКГ и артериального давления в период поллинии и ремиссии. Во время обострения повышались частота сердечных сокращений, систолическое и диастолическое давление, одновременно снижались показатели variability ритма. Результаты указывают на преобладание симпатической и гуморально-метаболической регуляции. Наиболее выраженные изменения наблюдались у пациентов с сочетанной патологией в период обострения сезонной аллергии.

Ключевые слова: variability сердечного ритма; поллиноз; атеросклеротическая болезнь сердца; симпатическая регуляция; воздействие аллергена.

Introduction: Hay fever is a seasonal allergic disorder characterized by inflammatory responses to pollen and may influence cardiovascular regulation. Atherosclerotic heart disease and arterial hypertension are cardiovascular conditions in which autonomic imbalance can contribute to functional deterioration. The coexistence of allergic and cardiovascular pathology is clinically relevant because inflammatory mediators, vascular responses, and autonomic mechanisms may interact during allergen exposure. Heart rate variability provides a noninvasive assessment of cardiac autonomic regulation and can reveal changes not evident from resting heart rate. In patients with cardiovascular disease, reduced variability may indicate impaired adaptive capacity and increased sympathetic influence. Seasonal pollen exposure creates a physiological stressor that permits comparison of autonomic regulation during remission and exacerbation. The study examined patients with hay fever accompanied by cardiovascular disease, patients with cardiovascular disease without hay fever, and healthy controls. Attention was given to heart rate, arterial pressure, and time- and frequency-domain parameters of heart rate variability. The study demonstrated increased heart rate and blood pressure during pollination, together with changes in SDNN, RMSSD, pNN50, LF, HF, and LF/HF. These findings suggest that allergen-induced inflammation can modify autonomic cardiovascular control. Therefore, assessment of heart rate

variability during pollen exposure may provide information about responses in allergic and cardiovascular disease and help identify unfavorable changes in autonomic balance for practice.

Aim of the study: To evaluate changes in heart rate, arterial blood pressure, and heart rate variability in patients with comorbid hay fever and cardiovascular disease during exposure to the clinically significant pollen allergen and during remission.

Materials and methods. The study included 60 patients aged 35–60 years living in the Republic of Crimea. Participants were divided into three groups: 20 patients with hay fever and cardiovascular disease, 30 patients with cardiovascular disease without symptoms of hay fever, and 10 healthy controls without hay fever or cardiovascular pathology. Cardiovascular conditions included atherosclerotic heart disease and symptomatic arterial hypertension. Patients with diabetes mellitus, thyroid disorders, advanced heart failure, acute coronary syndrome, acute or subacute myocardial infarction, pulmonary embolism, chronic obstructive pulmonary disease, autoimmune connective-tissue diseases, neurological disorders, hematological disease, moderate or severe anemia, and malignant tumors were excluded. The causative allergen was identified during remission by skin-prick testing. Participants were examined twice: during winter remission and during pollination of the clinically relevant allergen. Twenty-four-hour Holter ECG monitoring was performed using the DiaCard system, and ambulatory blood pressure monitoring was conducted. Heart rate variability was analyzed in time and frequency domains. Time-domain variables included SDNNi, SDANN, RMSSD, and pNN50. Spectral analysis included total power, VLF, LF, HF, and the LF/HF ratio. Heart rate, systolic blood pressure, diastolic blood pressure, and pulse pressure were also assessed. Statistical processing was performed using Microsoft Excel 2007 and Statistica 6.0. Means and standard deviations were calculated, and differences were evaluated using parametric and nonparametric procedures, including Student's t-test. A probability value below 0.05 was considered statistically significant.

Results. During pollen exposure, patients with hay fever and cardiovascular disease demonstrated a significant increase in heart rate to 80.1 ± 2.00 beats/min compared with 69.6 ± 2.00 beats/min during remission ($p < 0.001$). In the same group, systolic blood pressure increased to 141.8 ± 1.65 mmHg during pollination compared with 135.3 ± 1.56 mmHg in remission ($p < 0.001$), while diastolic pressure reached 84.9 ± 2.04 versus 82.6 ± 2.30 mmHg ($p = 0.018$). Among patients with cardiovascular disease without hay fever, heart rate was 84.0 ± 1.77 beats/min during pollination and 71.6 ± 1.89 beats/min during the second stage. Heart rate variability demonstrated a reduction of vagal-related indices during pollen exposure and remission. In the comorbid group, RMSSD was 50.2 ± 9.42 during pollination and decreased to 34.5 ± 1.89 during remission, the latter significantly below the control value of 83.5 ± 18.93 ($p = 0.030$). pNN50 was 15.06 ± 2.00 during exacerbation and 12.99 ± 1.98 during remission, both significantly lower than the control value of 24.4 ± 4.34 ($p = 0.023$ and $p = 0.010$). In patients with cardiovascular disease without hay fever, pNN50 was 14.99 ± 2.17 during pollination and 8.34 ± 1.18 during remission, with significant differences from controls ($p = 0.042$ and $p = 0.005$). The LF/HF ratio increased to 3.26 ± 0.36 and 3.50 ± 0.20 in the comorbid group during pollination and remission, compared with 1.96 ± 0.56 in controls. In the cardiovascular group, LF/HF reached 3.71 ± 0.38 during pollination and 4.48 ± 0.37 during remission. The study documented reduced LF, HF, and other variability parameters in several comparisons. Overall, this pattern indicated enhanced sympathetic influence and increased humoral-metabolic regulation during pollen exposure. The observed changes were most consistent with sympathetic activation.

Conclusions: Pollen exposure was associated with measurable changes in autonomic cardiovascular regulation in patients with hay fever and cardiovascular disease. During exacerbation, heart rate and arterial pressure increased, while several heart rate variability indices decreased. Reduced RMSSD and pNN50 indicated impaired short-term beat-to-beat variability, whereas increased LF/HF demonstrated a shift toward sympathetic predominance. In the comorbid group,

heart rate reached 80.1 ± 2.00 beats/min and systolic pressure 141.8 ± 1.65 mmHg during pollination. These findings suggest that seasonal allergic inflammation imposes additional autonomic stress on patients with cardiovascular disease. Heart rate variability may therefore be useful for functional monitoring during periods of allergen exposure clinically.

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