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A Method of Bioacoustic Correction in The Treatment of Autonomic Dysfunction Syndrome In Elderly Patients

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ABSTRACT

The steady increase in life expectancy worldwide has led to a growing proportion of elderly individuals, many of whom suffer from multiple comorbid chronic diseases. Autonomic dysfunction syndrome (ADS) is one of the common conditions observed in elderly patients and significantly affects their quality of life, adaptive capacity, and longevity. Age-related weakening of autonomic regulation plays an important role in the mechanisms of aging and in the development of psycho-physiological maladaptation.

This study explores the potential of bioacoustic correction as a non-pharmacological method for restoring autonomic balance in elderly patients with autonomic dysfunction syndrome. Bioacoustic correction is aimed at influencing neurovegetative regulation through targeted acoustic stimulation, thereby enhancing adaptive mechanisms of the organism. The relevance of this approach is determined by the high prevalence of comorbid pathology in elderly populations and the need for safe, effective, and well-tolerated treatment methods.

The application of bioacoustic correction may contribute to the normalization of autonomic regulation, improvement of adaptive responses, and reduction of functional disorders associated with aging. The method shows promise as a component of comprehensive therapy for autonomic dysfunction syndrome in elderly patients, potentially improving their functional status and quality of life.

Keywords: elderly patients; autonomic dysfunction syndrome; bioacoustic correction; autonomic regulation; aging; adaptation mechanisms; comorbidity; non-pharmacological treatment.

INTRODUCTION

In recent years, there has been a marked increase in the average life expectancy of the global population. According to WHO forecasts, trends characterizing population aging will continue, and by the beginning of 2024, the proportion of people of working age in the total population will increase to 26.7%, and by 2030, it will reach almost one-third – 28% [1,3].

It should be noted that only a small percentage of older people maintain their health, and most of them, upon reaching this age, acquire a number of chronic diseases, most often comorbid. According to many authors, comorbid pathology occupies a leading place in the structure of morbidity in elderly and senile patients, as among the general population of economically developed countries [4,9].

It is believed that as the body ages, various adaptive mechanisms are activated, providing compensation for emerging disorders [5,6]. In this regard, it is particularly important to study the adaptation mechanisms that, despite advanced age and the presence of various chronic and disabling diseases in many individuals, still ensure a sufficient lifespan. However, the question remains as to whether these adaptive mechanisms are uniform or whether the specific adaptation mechanisms depend on the nature of the underlying diseases.

The literature contains several indications that autonomic regulation is involved in the mechanisms of aging [2,4,8], and that a weakening of autonomic control with age is a general biological pattern. It can be hypothesized that the characteristics of autonomic regulation may reflect the mechanisms of psychophysiological adaptation in elderly and senile individuals to various forms of pathology and to changes in psychosocial status, which ultimately impacts the lifespan of these patients.

In the search for effective treatment methods, innovative approaches are being actively explored, including bioacoustic correction (BAC therapy), which has demonstrated encouraging results [7].

Objective: To evaluate the effectiveness of a rehabilitation method for elderly patients with neurovegetative regulation disorders using bioacoustic correction.

Material and methods: The study included 76 elderly patients diagnosed with autonomic dysfunction syndrome, divided into two main groups depending on the nature of the dysfunction: Group I (sympathicotonia): 42 patients (mean age 68.3 ± 3.9 years) and Group II (vagotonia): 34 patients (mean age 64.1 ± 4.5 years). All patients were inpatients in the Neurology Department of the Andijan State Medical Institute Clinic.

To evaluate treatment effectiveness, each group was divided into two subgroups: Subgroup A: Patients who received standard therapy plus BAC therapy: I-A: 20 patients and II-A: 17 patients; Subgroup B: Patients who received standard therapy alone: I-B: 22 patients and II-B: 17 patients.

The following treatment methods were used: Standard therapy: Included medication aimed at correcting VS symptoms, physiotherapy, and physical rehabilitation. BAC therapy: Used in combination with standard therapy and included bioacoustic correction sessions aimed at improving autonomic nervous system function and increasing the body's adaptive reserves.

Treatment effectiveness was assessed using the following parameters:

1. Orthostatic test: Measurement of blood pressure and heart rate in the supine position and after 3 minutes of standing. OH is defined as a decrease in SBP by ≥20 mmHg or DBP by ≥10 mmHg.
2. Stange cardiorespiratory tests: Assessment of endurance and cardiovascular function.
3. Ruffier and Skibinskaya indices: Assessment of physical endurance and cardiovascular adaptation.
4. Cardiointervalography: Analysis of heart rate variability to assess the balance of sympathetic and parasympathetic activity.

Results of the study. Table 1 shows the dynamics of the orthostatic test parameters in patients of groups I and II depending on the inclusion of BAC therapy in the complex of therapeutic measures. Group I, subgroup A (BAC): Patients who received BAC therapy demonstrated a significant decrease in systolic blood pressure (SBP) from 120 ± 10 to 115 ± 12 mmHg ($p < 0.05$), diastolic blood pressure (DBP) from 80 ± 8 to 75 ± 9 mmHg ($p < 0.05$) and heart rate (HR) from 75 ± 10 to 70 ± 11 beats/min ($p < 0.05$). Group I, subgroup B (control): Patients who received only standard therapy did not show significant changes in OH parameters: SBP decreased from 120 ± 10 to 118 ± 11 mmHg ($p = 0.20$), DBP - from 80 ± 8 to 78 ± 9 mmHg ($p = 0.25$), and HR - from 75 ± 10 to 73 ± 10 beats/min ($p = 0.30$).

Table 1.

Group	Group I		Group II	
Subgroup	A	B	A	B
SBP before treatment (mmHg)	120 ± 10	120 ± 10	115 ± 12	115 ± 12
SBP after treatment (mmHg)	115 ± 12	118 ± 11	105 ± 15	113 ± 13
DBP before treatment (mmHg)	80 ± 8	80 ± 8	75 ± 9	75 ± 9
DBP after treatment (mmHg)	75 ± 9	78 ± 9	60 ± 10	73 ± 10
Heart rate before treatment (bpm)	75 ± 10	75 ± 10	70 ± 11	70 ± 11
Heart rate after treatment (bpm)	70 ± 11	73 ± 10	60 ± 12	68 ± 11
Reliability criterion	p < 0,05	p = 0,20	p < 0,001	p = 0,30

Dynamics of orthostatic test parameters in patients of groups I and II

Group II, subgroup A (BAC): Patients with vagotonia who received BAC therapy showed a significant decrease in SBP from 115 ± 12 to 105 ± 15 mmHg (p < 0.001), DBP from 75 ± 9 to 60 ± 10 mmHg (p < 0.001) and HR from 70 ± 11 to 60 ± 12 bpm (p < 0.001). Group II, subgroup B (control): Patients with vagotonia who received only standard therapy did not show significant changes: SBP decreased from 115 ± 12 to 113 ± 13 mmHg. (p = 0.30), DBP – from 75 ± 9 to 73 ± 10 mmHg (p = 0.40), and HR – from 70 ± 11 to 68 ± 11 beats/min (p = 0.50).

Table 2.

Changes in the Stange cardiorespiratory tests, the Ruffier index and the Skibinskaya index

Group	Group I		Group II	
Subgroup	A	B	A	B
Stange test before treatment (score)	25 ± 5	25 ± 5	20 ± 6	20 ± 6
Stange test after treatment (scores)	30 ± 4 (p < 0,01)	26 ± 5 (p = 0,30)	28 ± 4 (p < 0,001)	21 ± 6 (p = 0,35)
Ruffier index before treatment	6,5 ± 1,2	6,5 ± 1,2	5,0 ± 1,0	5,0 ± 1,0
Ruffier index after treatment	8,0 ± 1,0 (p < 0,05)	6,8 ± 1,3 (p = 0,25)	7,5 ± 0,8 (p < 0,001)	5,2 ± 1,1 (p = 0,40)
Skibinskaya index before treatment	3,0 ± 0,5	3,0 ± 0,5	2,5 ± 0,6	2,5 ± 0,6
Skibinskaya index after treatment	3,8 ± 0,4 (p < 0,05)	3,1 ± 0,5 (p = 0,40)	4,0 ± 0,5 (p < 0,001)	2,6 ± 0,7 (p = 0,45)
Reliability criterion	Improvement	Insignificant	Improvement	Insignificant

Table 2 shows the changes in the Stange cardiorespiratory tests, the Ruffier index, and the Skibinskaya index. Group I, subgroup A (BAC): Patients who received BAC therapy showed significant improvement in all tests: the Stange test increased from 25 ± 5 to 30 ± 4 points (p < 0.01), the Ruffier index from 6.5 ± 1.2 to 8.0 ± 1.0 (p < 0.05), and the Skibinskaya index from 3.0 ± 0.5 to 3.8 ± 0.4 (p < 0.05). Group I, subgroup B (control): Patients who received only standard therapy did not show significant changes: the Stange test increased from 25 ± 5 to 26 ± 5 points (p = 0.30), the Ruffier index - from 6.5 ± 1.2 to 6.8 ± 1.3 (p = 0.25), the Skibinskaya index - from 3.0 ± 0.5 to 3.1

± 0.5 (p = 0.40).

Group II, subgroup A (BAC): Patients with vagotonia who received BAC therapy showed significant improvement in all tests: the Stange test increased from 20 ± 6 to 28 ± 4 points (p < 0.001), the Ruffier index - from 5.0 ± 1.0 to 7.5 ± 0.8 (p < 0.001), the Skibinskaya index - from 2.5 ± 0.6 to 4.0 ± 0.5 (p < 0.001). Group II, subgroup B (control): Patients with vagotonia who received only standard therapy did not show significant changes: the Stange test increased from 20 ± 6 to 21 ± 6 points (p = 0.35), the Ruffier index - from 5.0 ± 1.0 to 5.2 ± 1.1 (p = 0.40), the Skibinskaya index - from 2.5 ± 0.6 to 2.6 ± 0.7 (p = 0.45).

Table 3.

Cardiointervalography: changes in autonomic nervous system parameters

Group	Group I		Group II	
Subgroup	A	B	A	B
LF/HF before treatment (balance ratio)	2,0 ± 0,5	2,0 ± 0,5	1,8 ± 0,6	1,8 ± 0,6
LF/HF after treatment (balance ratio)	1,5 ± 0,4 (p < 0,05)	1,95 ± 0,5 (p = 0,30)	1,2 ± 0,3 (p < 0,001)	1,75 ± 0,6 (p = 0,40)
Mean RR before treatment (sec)	0,85 ± 0,05	0,85 ± 0,05	0,80 ± 0,06	0,80 ± 0,06
Average RR after treatment (sec)	0,90 ± 0,04	0,86 ± 0,05	0,95 ± 0,03	0,81 ± 0,06
Standard deviation of RR before treatment	0,02 ± 0,01	0,02 ± 0,01	0,03 ± 0,02	0,03 ± 0,02
Standard deviation of RR after treatment	0,02 ± 0,01	0,02 ± 0,01	0,02 ± 0,01	0,03 ± 0,02
Reliability criterion	Improvement	Insignificant	Improvement	Insignificant

Table 3 shows the changes in cardiointervalography parameters. Group I, subgroup A (BAC): Patients receiving BAC therapy showed a significant decrease in the LF/HF ratio from 2.0 ± 0.5 to 1.5 ± 0.4 (p < 0.05), an increase in the mean RR from 0.85 ± 0.05 to 0.90 ± 0.04 sec (p < 0.05) and a stable standard deviation of RR (0.02 ± 0.01 → 0.02 ± 0.01), indicating an improvement in the balance of the ANS and an increase in parasympathetic activity. Group I, subgroup B (control): Patients who received only standard therapy did not demonstrate significant changes in the ANS parameters: a decrease in LF/HF from 2.0 ± 0.5 to 1.95 ± 0.5 (p = 0.30), an increase in the average RR from 0.85 ± 0.05 to 0.86 ± 0.05 sec (p = 0.40) and a stable standard deviation of RR (0.02 ± 0.01 → 0.02 ± 0.01). Group II, subgroup A (BAC): Patients with vagotonia who received BAC therapy showed a significant decrease in the LF/HF ratio from 1.8 ± 0.6 to 1.2 ± 0.3 (p < 0.001), a significant increase in the mean RR from 0.80 ± 0.06 to 0.95 ± 0.03 sec (p < 0.001) and a decrease in the standard deviation of RR from 0.03 ± 0.02 to 0.02 ± 0.01, indicating a significant improvement in the balance of the ANS. Group II, subgroup B (control): Patients with vagotonia who received only standard therapy did not show significant changes: a decrease in LF/HF from 1.8 ± 0.6 to 1.75 ± 0.6 (p = 0.40), an increase in the average RR from 0.80 ± 0.06 to 0.81 ± 0.06 sec (p = 0.50) and a stable standard deviation of RR (0.03 ± 0.02 → 0.03 ± 0.02).

Thus, the study results demonstrate the high efficacy of bioacoustic correction (BAC therapy) in the combined treatment of autonomic dysfunction syndrome in elderly patients. Patients receiving BAC therapy (subgroup A) demonstrated significant improvements in orthostatic test parameters, Stange cardiorespiratory tests, Ruffier and Skibinskaya indices, and cardiointervalography parameters compared to subgroup B, which received standard therapy alone.

Conclusion. Effect of BAC therapy on orthostatic hypotension: Patients in both groups receiving BAC therapy demonstrated significant reductions in systolic and diastolic blood pressure, as well as heart rate. This indicates a positive effect of BAC therapy on cardiovascular regulation and improved adaptive capacity. A particularly pronounced improvement was observed in patients with vagotonia (Group II), which may be due to more pronounced disorders of the autonomic nervous system and a high degree of comorbidity.

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