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Features Of Orthostatic Hypotension In Elderly Patients With Chemical Medication

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Abstract

Chronic cerebral ischemia (CCI) is one of the most common neurological conditions in elderly patients and has a significant negative impact on functional status and quality of life. Progression of CCI is associated with cognitive decline, impaired postural control, reduced physical activity, and an increased risk of falls, largely due to vascular disorders and autonomic dysfunction. One of the key manifestations of autonomic impairment in this population is orthostatic hypotension, which contributes to statodynamic instability and traumatic complications.

The aim of this study was to identify the clinical features and pathogenetic mechanisms of orthostatic hypotension in elderly patients with different stages of chronic cerebral ischemia in order to optimize diagnostic approaches and develop individualized strategies for treatment and prevention.

The study included 147 elderly patients aged 60–89 years diagnosed with chronic cerebral ischemia and hospitalized in the neurological department of Andijan State Medical Institute between 2019 and 2022. Patients were divided into three groups according to the stage of CCI. A control group consisted of relatively healthy individuals. Clinical assessment included evaluation of postural stability using the Romberg and Unterberger tests, measurement of arterial blood pressure and heart rate in horizontal and vertical positions (orthostatic test), and statistical analysis.

The results demonstrated a progressive increase in the severity and frequency of autonomic disturbances with advancing stages of CCI. Patients with early-stage CCI exhibited mild autonomic symptoms, whereas those with advanced stages showed pronounced orthostatic hypotension, cardiac rhythm disturbances, thermoregulation disorders, and frequent syncopal episodes. These findings indicate a strong association between the progression of chronic cerebral ischemia and the severity of orthostatic hypotension, emphasizing the importance of early diagnosis and targeted management in elderly patients.

Keywords: Chronic cerebral ischemia; elderly patients; orthostatic hypotension; autonomic dysfunction; postural instability; statodynamic disorders; falls risk; neurovascular.

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1. Introduction

Chronic cerebral ischemia (CCI) is one of the most common pathologies in elderly patients, significantly impacting their quality of life. Progression of CCI leads to cognitive impairment, decreased physical activity, deterioration of balance, and an increased risk of falls. These changes are caused by both vascular disorders and progressive autonomic dysfunction (1,3,6).

The study of statodynamic disturbances in patients with CCI deserves special attention, as these disorders most often cause disability, decreased daily activity, and an increased risk of fall-related injuries. Given the aging population and the increasing incidence of chronic vascular diseases, the diagnosis and treatment of statodynamic disturbances are particularly important (5,6,7,8).

Despite the existence of various methods for assessing statodynamic functions, clinical practice lacks a comprehensive approach that would incorporate objective data from stabilometry, biomechanical analysis, and questionnaires. This requires further research aimed at clarifying the frequency, structure, and characteristics of such disorders in patients with different stages of CCI (2, 4, 5).

This study examines the prevalence of statodynamic disorders and their relationship with the progression of CCI, which is important for optimizing diagnostic and rehabilitation approaches.

The aim of this study was to identify the clinical features and pathogenetic mechanisms of orthostatic hypotension in elderly patients with various stages of chronic cerebral ischemia (CCI) to optimize diagnosis and develop individualized approaches to treatment and prevention.

Materials and Methods

The study included 147 patients diagnosed with CCI, hospitalized in the neurology department of the Altai State Medical Institute Clinic between 2019 and 2022. The subjects ranged in age from 60 to 89 years (mean age 72.3 ± 11.7 years).

Patients were divided into 3 groups depending on the stage of CCI. Group I (n=48, 32.6%) included patients with stage I CCI (mean age 63.1±5.1 years); Group II (n=64, 43.5%) — with stage II CCI (mean age 74.2±8.4 years); Group III (n=35, 23.8%) — with stage III CCI (mean age 79.6±9.4 years). The control group (n=20) included relatively healthy individuals (mean age 53.1±6.4 years).

Research methods

The following research methods were used to assess orthostatic disorders in patients: Assessment of postural stability and the presence of orthostatic hypotension using the Romberg and Unterberger tests. Measurement of blood pressure (BP) and heart rate (HR) in a horizontal position and when moving to a vertical position (orthoclinostatic test). Statistical analysis.

Study results

In patients with chronic cerebral ischemia (CCI), we observed a variety of autonomic symptoms, the severity of which increases with disease progression. In group I (CCI I), symptoms are predominantly mild, such as hyperhidrosis, orthostatic hypotension, and tachycardia. In group II (CCI II), symptoms become more pronounced: orthostatic hypotension increases, episodes of arrhythmia and thermoregulatory disturbances become more frequent. Group III (CCI III) exhibits the most severe manifestations of autonomic dysfunction, including frequent syncope, severe arrhythmias, significant thermoregulatory disturbances, and gastrointestinal disturbances.

Table 1 shows the results of the orthoclinostatic test in patients with CCI in groups. Group I (CMI I): Orthostatic hypotension: Often observed in patients with CMI I, especially with a sharp change in body position (in 20.8% of cases). Increased sweating, especially in the palms and soles of the feet (in 18.7% of patients). Patients with CMI I sometimes experience episodes of increased heart rate and irregular heartbeat (in 25.0%). Increased fatigue and weakness: Often accompanied by a decrease in overall activity, which is associated with impaired autonomic regulation (in 31.2% of cases).

Group II (CMI II): Severe orthostatic hypotension: In 39.1% of patients, significant fluctuations in blood pressure are observed with changes in body position,

leading to dizziness and fainting. Changes in the autonomic regulation of sweating are observed, leading to episodes of both increased sweating and dry skin (in 29.7%). Cardiovascular symptoms: Severe tachycardia, irregular heart rhythms, and a feeling of heart palpitations (in 42.2% of patients). Impaired thermoregulation: Patients complain of a feeling of coldness in the extremities, especially at night (in 33.3%).

Group III (CHI III): Severe orthostatic hypotension in 52.3% of patients, changes in autonomic regulation of sweating in 46.9%, irregular heart rhythms in 64.3% of patients, and a feeling of coldness in the extremities, especially at night in 46.2%. Patients in Group III also have decreased exercise tolerance: Patients experience severe weakness and shortness of breath with minimal physical activity, such as walking or climbing stairs. This significantly limits their ability to perform daily tasks and requires ongoing monitoring and treatment adjustments.

To present the results of the orthoclinostatic test in patients with chronic In each group, mean values and standard deviations were calculated for the following parameters: heart rate (HR) and blood pressure (BP) when transitioning from a horizontal to a vertical position. This allows for a more accurate assessment of the degree of changes in autonomic regulation in each group.

Table1.

Results of the orthoclinostatic test in patients with CCI in groups, (M±σ).

Indicator		Group I	Group II	Group III
Heart rate (HR), bpm	Before the audition	72,4 ± 5,3	74,8 ± 6,1	76,3 ± 7,0
	after the test	85,1 ± 7,2	95,6 ± 8,5	84,0 ± 9,1
Heart rate difference	ΔHR:	(+12,7 ± 4,1)	(+20,8 ± 5,8)	(+7,7 ± 4,5)
Systolic blood pressure (mmHg)	Before the audition	129,2 ± 10,1	134,5 ± 11,8	138,7 ± 12,4
	after the test	122,8 ± 9,7	120,3 ± 12,5	110,2 ± 14,3
Systolic blood pressure difference	ΔADsist:	(-6,4 ± 3,2)	(-14,2 ± 5,4)	(-28,5 ± 7,1)
Diastolic blood pressure (mmHg)	Before the audition	82,3 ± 6,5	84,1 ± 7,2	86,4 ± 8,0
	after the test	78,7 ± 5,8	75,4 ± 7,9	68,9 ± 9,3
Diastolic blood pressure difference	ΔADdiast:	(-3,6 ± 2,4)	(-8,7 ± 3,9)	(-17,5 ± 5,6)

In Group I, the average HR before the test was 72.4 ± 5.3 beats/min. After moving to the vertical position, the HR increased to 85.1 ± 7.2 beats/min. The average HR difference was +12.7 ± 4.1 beats/min, which indicates preserved adaptation to orthostasis. In Group II: The average HR before the test was 74.8 ± 6.1 beats/min. After moving to the vertical position, the HR increased to 95.6 ± 8.5 beats/min, which is significantly higher than in Group I. The HR difference was +20.8 ± 5.8 beats/min, which indicates increased sympathetic activity and an attempt to compensate for the decrease in blood pressure. In Group III: The average HR before the test was 76.3 ±

7.0 beats/min. After the test, the heart rate was 84.0 ± 9.1 bpm, indicating an insufficient response to orthostasis. The heart rate difference was +7.7 ± 4.5 bpm, and in some cases, paradoxical bradycardia was even observed, indicating a significant reduction in adaptive capacity (Table 1).

Table 2 shows the results of the orthoclinostatic test in patients with CCI depending on gender in Group I. The mean systolic BP before the test was 129.2 ± 10.1 mmHg. After moving to the vertical position, BP decreased to 122.8 ± 9.7 mmHg. The difference in systolic BP was -6.4 ± 3.2 mmHg, which is a normal response. Group II (CCI II): The mean systolic BP before the test was 134.5 ± 11.8 mmHg. After moving to the vertical position, BP decreased to 120.3 ± 12.5 mmHg. The difference in systolic BP was -14.2 ± 5.4 mmHg, which indicates severe orthostatic hypotension in some patients. Group III (CIM III): The mean systolic BP before the test was 138.7 ± 12.4 mmHg. After the test, BP decreased to 110.2 ± 14.3 mmHg. The difference in systolic BP was -28.5 ± 7.1 mmHg, which indicates significant disturbances of orthostatic regulation and the absence of adequate compensation. The mean diastolic BP before the test was 82.3 ± 6.5 mmHg. After moving to the vertical position, BP decreased to 78.7 ± 5.8 mmHg. The difference in diastolic BP was -3.6 ± 2.4 mmHg. Group II (CIM II): The mean diastolic BP before the test was 84.1 ± 7.2 mmHg. After moving to a vertical position, blood pressure decreased to 75.4 ± 7.9 mmHg. The difference in diastolic blood pressure was -8.7 ± 3.9 mmHg, which also indicates deterioration of compensation. Group III (CIM III): The average diastolic blood pressure before the test was 86.4 ± 8.0 mmHg. After the test, blood pressure decreased to 68.9 ± 9.3 mmHg. The difference in diastolic blood pressure was -17.5 ± 5.6 mmHg, which is a significant decrease and indicates decompensation of regulatory mechanisms (Table 2).

Table2.

Results of the orthoclinostatic test in patients with chronic cerebral ischemia (CCI) depending on gender. Group I (CCI I, 48 patients: 25 men and 23 women), (M±σ).

Indicator		Men (n=25)	Women (n=23)
Heart rate (HR), bpm	Before the audition	71,5 ± 5,1	73,4 ± 5,5
	after the test	83,7 ± 7,4	86,6 ± 6,9
Heart rate difference (ΔHR)	ΔHR:	+12,2 ± 4,0	+13,2 ± 4,2
Systolic blood pressure (mmHg)	Before the audition	128,3 ± 10,5	130,1 ± 9,7
	after the test	123,9 ± 9,9	121,6 ± 9,5
Systolic blood pressure difference (ΔBPsyst)	ΔADsist:	(-4,4 ± 3,1)	(-8,5 ± 3,3)
Diastolic blood pressure (mmHg)	Before the audition	82,1 ± 6,3	82,5 ± 6,8
	after the test	79,2 ± 5,7	78,2 ± 5,9
Diastolic blood pressure difference (ΔADdiast)	ΔADdiast:	(-2,9 ± 2,3)	(-4,3 ± 2,5)

Orthoclinostatic test results in patients with CCI demonstrate a progressive deterioration in autonomic regulation of the cardiovascular system as they progress from CCI stage I to CCI stage III. In the CCI stage I group, adequate adaptation to orthostasis is maintained, as evidenced by moderate changes in heart rate and blood pressure.

Table 2 shows the orthoclinostatic test results in patients with CCI by gender in the CCI stage II group. More pronounced changes are observed, indicating a deterioration in adaptive capacity, particularly in terms of increased heart rate and decreased blood pressure. In the CCI stage III group, significant dysregulation was detected, manifested by pronounced orthostatic hypotension and an insufficient heart rate response, leading to frequent episodes of dizziness and the need for assistance.

Tables 1 and 2 present the results of the orthoclinostatic test in patients with chronic cerebral ischemia (CCI) depending on gender in each group. The mean values and standard deviations of heart rate (HR) and blood pressure (BP) in response to changes in body position were used for the assessment. This allows us to evaluate the differences in the responses of the male and female subgroups at each stage of CCI.

Group I (CCI I), Men: Moderate increase in HR upon standing, the average difference is +12.2 ± 4.0 bpm. A slight decrease in systolic BP, the difference is -4.4 ± 3.1 mmHg. BP and HR indicators indicate good adaptation to orthostasis. Women: The difference in HR upon standing is slightly higher than in men (+13.2 ± 4.2 bpm). The decrease in systolic blood pressure is more pronounced (-8.5 ± 3.3 mmHg), indicating increased sympathetic activity (Table 3.4).

Group II (CMI II), Men: The average heart rate difference is +19.1 ± 5.5 bpm, indicating a marked increase in sympathetic activity. The decrease in systolic blood pressure is -11.3 ± 5.2 mmHg, indicating a decrease in adaptation to orthostasis. Women: The heart rate difference is higher than in men (+22.4 ± 6.0 bpm), indicating a greater tendency toward tachycardia. The decrease in systolic blood pressure is significantly pronounced (-16.6 ± 5.7 mmHg), which may indicate a higher risk of orthostatic hypotension (Table 3.5).

Group III (HIM III) Men: The difference in heart rate is +6.6 ± 4.3 beats/min, which indicates an insufficient response to orthostasis. The decrease in systolic blood pressure is -23.9 ± 6.9 mmHg, which indicates significant problems with the regulation of vascular tone.

Table 3.

Results of the orthoclinostatic test in patients with CCI depending on gender, Group II, (M±σ).

Indicator		Men (n=29)	Women (n=35)
Heart rate (HR), bpm	Before the audition	74,0 ± 6,0	75,4 ± 6,3
	after the test	93,1 ± 8,3	97,8 ± 8,6
Heart rate difference (ΔHR)	ΔHR:	+19,1 ± 5,5	+22,4 ± 6,0
Systolic blood pressure (mmHg)	Before the audition	133,7 ± 12,0	135,2 ± 11,6
	after the test	122,4 ± 12,3	118,6 ± 12,7
Systolic BP difference (ΔBPsyst)	ΔADsist:	(-11,3 ± 5,2)	(-16,6 ± 5,7)
Diastolic BP (mmHg)	Before the audition	83,8 ± 7,3	84,4 ± 7,1
	after the test	76,5 ± 7,8	74,3 ± 8,0

Diastolic BP difference (ΔBPdiast)	ΔADdiast:	(-7,3 ± 3,7)	(-9,9 ± 4,1)

Women: The difference in heart rate is slightly higher than in men (+8.6 ± 4.7 bpm), but insufficient for adequate compensation. The decrease in systolic blood pressure is most pronounced (-31.8 ± 7.4 mmHg), indicating a high degree of dysregulation and a tendency toward orthostatic disorders (Table 4). The results of the orthoclinostatic test show that differences in responses to orthostasis between men and women are present in all groups, but become more pronounced with the progression of the stage of CCI.

Table 4

Results of the orthoclinostatic test in patients with CCI depending on gender, Group III, (M±σ).

Indicator		Men (n=15)	Women (n=20)
Heart rate (HR), bpm	Before the audition	75,9 ± 7,2	76,6 ± 6,8
	after the test	82,5 ± 8,8	85,2 ± 9,3
Heart rate difference (ΔHR)	ΔHR:	+6,6 ± 4,3	+8,6 ± 4,7
Systolic blood pressure (mmHg)	Before the audition	137,1 ± 12,8	139,8 ± 11,9
	after the test	113,2 ± 13,9	108,0 ± 14,5
Systolic blood pressure difference (ΔBPsyst)	ΔADsist:	(-23,9 ± 6,9)	(-31,8 ± 7,4)
Diastolic blood pressure (mmHg)	Before the audition	85,7 ± 8,2	86,9 ± 7,8
	after the test	70,4 ± 9,1	68,0 ± 9,5
Diastolic blood pressure difference (ΔADdiast)	ΔADdiast:	(-15,3 ± 5,4)	(-18,9 ± 5,8)

Women in all groups have a more pronounced decrease in systolic blood pressure upon standing and a greater difference in heart rate, which may indicate greater sympathetic activity and a tendency toward orthostatic hypotension. Men demonstrate more moderate changes in heart rate and blood pressure, suggesting better adaptation to orthostasis compared to women, especially in the early stages of CCI.

This study demonstrated that chronic cerebral ischemia (CCI) significantly influences the development of statodynamic disorders in elderly patients. As the disease progresses, the severity of autonomic dysfunction increases, manifested by deterioration of postural stability, an increased risk of falls, and significant impairment of orthostatic regulation. These data demonstrate the need for early diagnosis and the development of individualized treatment programs to

minimize functional limitations in this patient population. Conclusions:

Patients with stage I CCI predominantly experience mild forms of autonomic dysfunction and statodynamic disturbances, characterized by preserved adaptation to orthostasis.

Stage II CCI exhibits an increase in the frequency and severity of disturbances, including increased orthostatic hypotension, which significantly reduces patients' functional capacity.

Stage III CCI is characterized by the most pronounced impairments of statodynamic functions, a significant decrease in adaptation to orthostasis, and an increased risk of falls, requiring a comprehensive approach to rehabilitation.

Women in all groups demonstrate more pronounced changes in heart rate and blood pressure in response to orthostasis, which may indicate a higher susceptibility to orthostatic hypotension and imbalance.

To objectively assess patients' condition and identify disorders, it is necessary to use a combination of methods, including clinical, instrumental, and questionnaire approaches, allowing for an accurate assessment of the extent of autonomic dysfunction and the development of effective treatment strategies.

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