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EFFICACY OF COMORBID OSTEOARTHRISIS WITH ARTERIAL HYPERTENSION CONTROL CONSIDERING THE TYPES OF ORTHOSTATIC REACTIONS AND CARCADIAN PROFILES OF ARTERIAL PRESSURE

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Clinical peculiarities, heart rate variability and effectiveness of comorbid osteoarthritis with arterial hypertension control considering the types of orthostatic reactions and circadian profiles of blood pressure were established. In patients with comorbid osteoarthritis with arterial hypertension all three types of systolic and diastolic blood pressure orthostatic reactions with the prevalence of hypertensive were observed, and all of four types of diurnal profiles — with a prevalence of non-dipper on systolic blood pressure and dipper for diastolic. The detrimental types of arterial pressure orthostatic responses were observed in 12 % of systolic and in 15 % of diastolic type in patients with comorbid OA with AH then with isolated one. Migration regularities of blood pressure orthostatic reactions in patients with comorbid osteoarthritis with arterial hypertension on the stages of therapy were revealed and it was determined that migration of systolic blood pressure was higher into the hypertensive type, diastolic — into hypotensive. It was determined that comorbid with arterial hypertension osteoarthritis had no effect on baseline indexes of heart rate variability, but affected the reactions on orthostasis. In the management of patients it should be taken into account that in hypotensive and isotensive of orthostatic reactions, dipper and night-peaker circadian profiles of systolic blood pressure and night-peaker profiles of diastolic blood pressure require more intensive antihypertensive therapy. In studied clinical signs and heart rate variability indices statistically significant criteria of arterial hypertension comorbid with osteoarthritis efficacy control were patients age and sympatho-vagal balance ratio.

KEY WORDS: hypertension, osteoarthritis, comorbidity, orthostatic reactions, circadian profile, blood pressure

ЕФЕКТИВНІСТЬ КОНТРОЛЮ КОМОРБІДНОЇ З ОСТЕОАРТРОЗОМ АРТЕРІАЛЬНОЇ ГІПЕРТЕНЗІЇ З УРАХУВАННЯМ ТИПІВ ОРТОСТАТИЧНИХ РЕАКЦІЙ І ДОБОВИХ ПРОФІЛІВ АРТЕРІАЛЬНОГО ТИСКУ

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Встановлені клінічні особливості, варіабельність серцевого ритму і ефективність контролю коморбідної з остеоартрозом артеріальної гіпертензії у залежності від типів ортостатичних реакцій і добових профілів артеріального тиску. У хворих на коморбідну з ОА АГ спостерігалися три типи ортостатичних реакцій артеріального тиску з переважанням гіпертензивного за систолічним (47 %) і діастолічним (44 %). Несприятливі типи ортостатичних реакцій артеріального тиску зустрічалися на 12 % по систолічному і на 15% по діастолічному частіше у хворих на коморбідну з ОА АГ, ніж на ізольовану. Виявлено, що у хворих на коморбідну з остеоартрозом артеріальну гіпертензію спостерігалися три типи добових профілів систолічного артеріального тиску (dipper, non-dipper, night-peaker) з переважанням non-dipper (43 %) та всі чотири типи добових профілів діастолічного з переважанням dipper (52 %). Виявлені закономірності міграції ортостатичних реакцій артеріального тиску у хворих на коморбідну з остеоартрозом артеріальну гіпертензію на етапах терапії та встановлено, що міграція систолічного артеріального тиску більшою мірою відбувалася у гіпертензивний тип, діастолічного — у гіпотензивний. Встановлено, що коморбідність артеріальної гіпертензії з остеоартрозом не впливала на вихідні показники варіабельності серцевого ритму, але при цьому порушувала реакції на ортостаза. У менеджменті хворих на коморбідну з остеоартрозом артеріальну гіпертензію необхідно враховувати те, що при гіпотензивній та ізотензивній ортостатичних реакціях, dipper та night-peaker добових профілях систолічного артеріального тиску та night-peaker діастолічного — необхідна більш інтенсивна антигіпертензивна терапія. Серед сукупності вивчених клінічних ознак і показників варіабельності серцевого

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ритму статистично значимими критеріями ефективності контролю АТ у хворих на коморбідну з остеоартрозом артеріальну гіпертензію виявилися вік хворих та співвідношення симпато-вагального балансу.

КЛЮЧОВІ СЛОВА: артеріальна гіпертензія, остеоартроз, коморбідність, ортостатичні реакції, добові профілі, артеріальний тиск

ЭФФЕКТИВНОСТЬ КОНТРОЛЯ КОМОРБИДНОЙ С ОСТЕОАРТРОЗОМ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИИ В ЗАВИСИМОСТИ ОТ ТИПОВ ОРТОСТАТИЧЕСКИХ РЕАКЦИЙ И СУТОЧНЫХ ПРОФИЛЕЙ АРТЕРИАЛЬНОГО ДАВЛЕНИЯ

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Установлены клинические особенности, вариабельность сердечного ритма и эффективность контроля коморбидной с остеоартрозом артериальной гипертензии с учетом типов ортостатических реакций и суточных профилей артериального давления. У больных коморбидной с остеоартрозом артериальной гипертензией наблюдались три типа ортостатических реакций артериального давления с преобладанием гипертензивной по систолическому (47 %) и диастолическому (44 %). Неблагоприятные ортостатические реакции артериального давления встречались на 12% чаще по систолическому артериальному давлению и на 15 % по диастолическому у больных коморбидной с остеоартрозом артериальной гипертензией, чем с изолированной. У больных коморбидной с остеоартрозом артериальной гипертензией наблюдались три типа суточных профилей систолического артериального давления с преобладанием non-dipper (43 %) и все четыре диастолического с преобладанием dipper (52 %). Выявлены закономерности миграции ортостатических реакций артериального давления у больных коморбидной с остеоартрозом артериальной гипертензией на этапах терапии и установлено, что миграция систолического артериального давления в большей степени происходила в гипертензивный тип, диастолического — в гипотензивный. Установлено, что коморбидность артериальной гипертензией с остеоартрозом не влияла на исходные показатели вариабельности сердечного ритма, но при этом нарушала ее реакции на ортостаз. При ведении больных коморбидной с остеоартрозом артериальной гипертензии с гипотензивной, изотензивной ортостатическими реакциями, dipper и night-peaker суточными профилями систолического артериального давления и night-peaker диастолического рекомендуется более интенсивная антигипертензивная терапия. Среди совокупности изученных клинических признаков и показателей вариабельности сердечного ритма статистически значимыми критериями эффективности контроля артериального давления у больных коморбидной с остеоартрозом артериальной гипертензией оказались возраст больных и соотношение симпатовагального баланса.

КЛЮЧЕВЫЕ СЛОВА: артериальная гипертензия, остеоартроз, коморбидность, ортостатические реакции, суточные профили, артериальное давление

Problem of comorbidity becomes more important in the patients managements and its actuality is raising especially for arterial hypertension (AH) and osteoarthritis (OA) [1–3]. Increase of morbidity with age, common risk factors and pathogenic mechanisms [4–7], and also possibility of mutual aggravation lead to worsening of patients quality of life and to economic losses of State as a result.

Investigation of orthostatic reactions (OR) of blood pressure (BP) [8–11], diurnal profiles (DP) of BP [12, 13] and heart rate variability (HRV) [14, 15] reflects the degree of stresses in the regulatory systems which play an important role in AH and OA pathogenesis.

The data of BP control efficacy in patients with comorbidity of OA with AH and depending on the type of OR and DP of BP were not

found in the literature in spite of the problem actuality.

Target. To define the cormobid osteoarthritis with arterial hypertension control efficacy considering the types of orthostatic reactions and diurnal profiles of arterial pressure.

MATERIALS AND METHODS

111 patients: 31 men and 80 women (58 ± 11 years old) who have been consulted at the Kharkov city clinics №6 during 2007–2010 years were included to the current study. 98 (88 %) patients were diagnosed with AH including 26 with mild (26 %), 49 with moderate (51 %) and 23 with severe (23 %) rates. Stage I of AH was diagnosed in 11 (11 %) patients, stage II — in 71 (73 %), stage III — in 16 (16 %). 56 patients were with chronic heart

failure (HF) of I and II A stages (I — in 31 (55 %) and II A — in 25 (45 %)) by classification of Strazhesko-Vasilenko. The I-st functional class of HF was diagnosed in 25 patients (45 %), II — in 31 (55 %) according to the NYHA classification. OA was diagnosed in 58 patients (52 %) including 32 (58 %) with II stage (58 %) and 26 (42 %) with III, the I-st stage of OA was not detected.

The work deals with the estimation of the effectiveness of control of arterial hypertension and osteoarthritis comorbidity depending on types of orthostatic reactions and diurnal profiles of blood pressure.

45 patients of total 111 were examined with comorbidity of AH and OA (observation group — AH + OA), 53 with isolated arterial hypertension (first comparison group — IAH) and 13 — with isolated OA (2nd comparison group — IOA). Control group (CG): 36 mostly healthy individuals of the same age as the patients in the observation group.

The criteria for involving to the study were: AH of 1, 2 and 3 rates of I–III stage and primary OA. Exclusion criteria from the study were: myocardial infarction, unstable angina, stable angina of IV functional class, stroke in history card, arterial fibrillation, implanted pacemakers, severe arrhythmias and conduction of the heart, HF IIb–III stage, III–IV functional class HF by NYHA, diabetes mellitus, obesity of III–IV rate, chronic respiratory disease, ulcer disease, thyroid disease, IV stage joints injury radiographically by Kellgren-Lawrence classification.

The diagnosis of AH was verified according to the Ukrainian Association of cardiologists of the prevention and treatment of arterial hypertension recommendations (2008). The diagnosis of OA was stated according to the Association of rheumatologists of Ukraine and the Association of orthopedists, traumatologists of Ukraine recommendations (2004).

AP measurement was done early in the morning according to Korotkov method by Microlife BP AG1–40 blood pressure monitor in clinostasis after 5-minutes rest and in 3 minutes after transfer to orthostasis. During orthostatic sample procedure increase of systolic and diastolic AP in 5 and more mm Hg was classified as hypertentional OR, decrease of systolic and diastolic AP in 5 and more mm Hg — as hypotentional OR, change of systolic and diastolic AP not more than 5 mm Hg — as isotensive OR.

DPAP was done with the help of cardiographic complex «CARDIOSENSE». According to the results of the investigation DPAP was estimated after the level of their night decrease (LND): 1 — over-dipper — LND > 20 %, 2 — dipper — 10 % < LND < 20 %; 3 — non-dipper — LND < 10 %; 4 — night-peaker — LND < 0 %.

HRV was defined with the help of electrocardiograph «CARDIOLAB». For HRV analysis ECG was registered in other standard allotment consequently in clinostasis and orthostasis (HRV sample for orthostasis). Spectral analysis of HRV was done with the help of Fourier quick transformation. The spectrum total power (Total power — TP, μV^2) and proportion of sympathetic balance (Low Frequency/High Frequency — LF/HF) were studied. The sample of metronomized breathing was performed, the respiratory rate was defined individually for each patient in proportion: inhale (3 seconds) — exhale (4 seconds). Average 5 minutes of 7-minutes monitor ECG record were treated.

The AH therapy was based on the Ukrainian Association of cardiologists recommendations, OA — on the Association of rheumatologists of Ukraine and the Association of orthopedists, traumatologists of Ukraine recommendations.

Before the beginning of the therapy the patients in all groups were categorized into subgroups according to OR of SAP type and OR of DAP type into: hypertensive, isotensive, hypotensive types of OR. Before the beginning of the therapy the patients in all groups were categorized into subgroups according to DP of SAP type and DP of DAP type into: with DP, dipper, non-dipper, over-dipper and night-peaker.

The patients were examined before the therapy, after 2 weeks, 1, 3, 6 and 12 months from the beginning of the therapy.

The received results were processed after database formation in «Microsoft Excel 2007». Statistic procedures were executed with the help of the programs «Microsoft Excel 2007», «Mathcad 14.0». The Mann-Witney criterion was used for statistical estimation of the results. In defining the differences between the groups authenticity the confidential intervals 95 % and 99 % were used. The features incidence studied was indicated in percentage, average errors of the percentage were indicated in the tables by V. S. Genes.

RESULTS AND DISCUSSION

Cormobid OA with AH in comparison with isolated one was characterized by

more prominent frequency of occurrence and more severe manifestations of HF (table 1).

Table 1

Clinical characteristics of the patients with AH+OA and IAH taking into account age, sex, level and stage of the disease (% ± Sp), M ± sd

Indices		Groups of the patients	
		AH+OA	IAH
Number of the patients	total	46 ± 9	54 ± 9
	men	27 ± 8	36 ± 9
	women	73 ± 8	64 ± 9
Age, years (M±sd)		58 ± 11	58 ± 11
Level of AH (%± Sp)	1	20 ± 7	32 ± 8
	2	56 ± 10	45 ± 8
	3	24 ± 8	23 ± 7
Stage of AH (%± Sp)	I	7 ± 4	15 ± 6
	II	69 ± 8	76 ± 7
	III	24 ± 8	9 ± 5
Stage HF (%± Sp)	0	29 ± 8	48 ± 9
	I	47 ± 9	43 ± 9
	IIA	24 ± 8	9 ± 5
FC of HF (%± Sp)	I	76 ± 8	89 ± 6
	II	24 ± 8	11 ± 6
Stage of OA (%± Sp)	I	–	–
	II	56 ± 9	–
	III	44 ± 9	–

All three types of OR of SAP with hypertensive prevalence were observed in groups AH + OA and IAH. Hypotensive type of OR of SAP was found more frequently in the group AH+OA, isotensive — in the group with IAH. In the group with IOA the patients with isotensive type of OR of SAP

dominated (fig. 1).

In all comparative groups including the group with HC all three types of OR of DAP with hypertensive prevalence were observed. Hypotensive type of OR of DAP was observed more frequently in the group AH + OA, isotensive — in the group IAH (fig. 2).

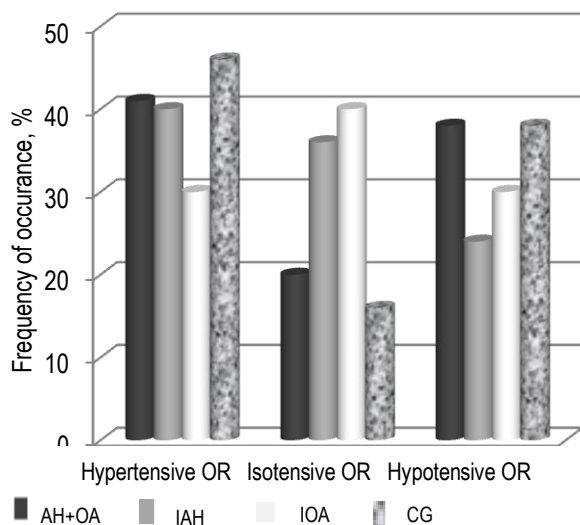


Fig. 1. Frequency of occurrence of OR of SAP in the limits of defined groups AH+OA, IAH, IOA and HC

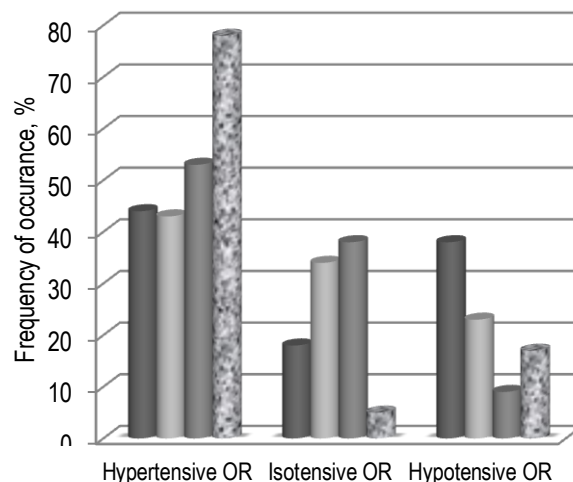


Fig. 2. Frequency of occurrence of various types of OR of DAP in the limits of defined groups AH+OA, IAH, IOA and HC

Regardless all types of OR of SAP and OR of DAP under AH + OA the level and stage of AH, functional classes and stages of HF were higher. Three types of DP of DAP with non-dipper prevalence were observed. Night-peaker were found more frequently in the group AH+OA, dipper — in the group IAH. Over-dipper was not found in any group (fig. 3).

All three types of DP of DAP with dipper prevalence were observed in the groups AH + OA and IAH. Non-dipper was observed more frequently in the group AH + OA and night-peaker and over-dipper — in the group IAH. In the group IOA dipper and non-dipper were found with the same frequency (fig. 4).

Combination of detrimental DP of SAP and DP of DAP were observed more frequently (7 %) in patients with cormobid OA with AH than with isolated AH.

HRV was identically low in the groups AH + OA and IAH than in the groups IOA and HC before the beginning of TR therapy. Correlation LF/HF was greater under AH + OA, than under IAH, IOA and HC. Improper reaction was observed in the group AH + OA before the beginning of therapy, in the groups IAH and IOA — the reaction on orthostasis was proper. In three comparison groups proper reaction on metronomized breathing was observed (table 2).

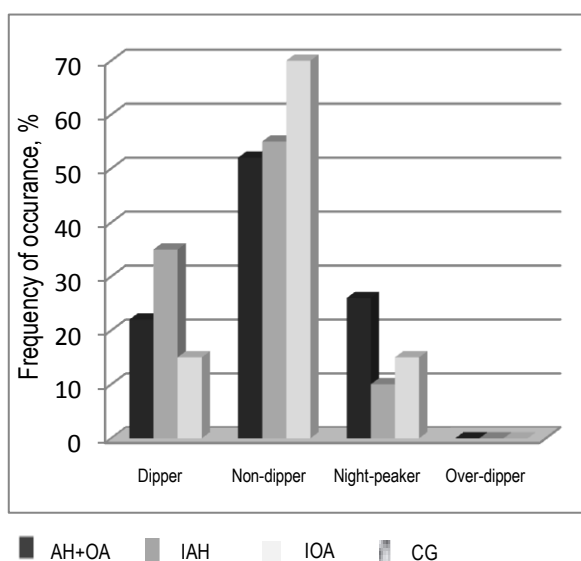


Fig. 3. Frequency occurrence of various types of DP of SAP in the limits of defined groups AH+OA, IAH and IOA

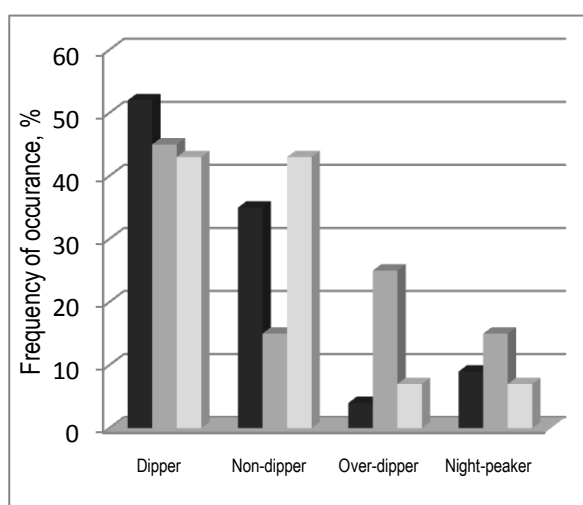


Fig. 4. Frequency occurrence of various types of DP of DAP in the limits of defined groups AH+OA, IAH and IOA

Table 2

TR and LF/HF (M ± sd) in the limits of defined groups AH+OA, IAH, IOA, HC

HRV indices	Samples	Groups of patients			
		AH+OA	IAH	IOA	HC
TR, mc ²	clinostasis	1301,3 ± 1011	1369 ± 927,8	1423,6 ± 1131,1	2120 ± 1674
	orthostasis	1313,1 ± 1046,6	1300 ± 929,2	1358 ± 963	1850 ± 1298##
	metronom. breathing	2180,0 ± 1731,5##	2394,1 ± 1689,1##	3513,8 ± 2534##	3580 ± 2107##
LF/HF, dimensionless	clinostasis	3 ± 1,8	2,4 ± 1,7	2,6 ± 1,7	1,2 ± 1,2
	ortostasis	5 ± 3,5##	4,2 ± 3##	4,7 ± 4,1##	5,3 ± 1,5##
	metronom. breathing	3,9 ± 3,2##	4,6 ± 3,6##	4,2 ± 3##	4,9 ± 1,2##

Note:

p < 0,05, ## p < 0,01 — between indises inside the groups on the corresponding stages of the investigation

Adequate control of AP led to the improvement of HRV indices in patients with regeneration of proper reactions on orthostasis. In the groups AH + OA, IAH, IOA in patients with

various types of OR and DP of SAP and DAP no essential differences in HRV indices were found (p > 0,05). The output SAP in patients with AH+OA was higher, than in patient with

IAH ($p > 0,05$). Efficacy control of SAP under AH + OA was lower than under IAH. The output DAP under AH + OA was higher than under IAH ($p > 0,05$), while therapy was simi-

larly effective in both groups ($p > 0,05$). SAP and DAP lowered consequently in 24 % and 18 % in the group AH + OA, in 22 % and 18 % in the group IAH in 12 months (table 3).

Table 3

Changes of SAP and DAP on the stages of therapy in groups of the patients AH+OA and IAH (M ± sd)

Stages of therapy	Groups of patients			
	AH+OA		IAH	
	SAP	DAP	SAP	DAP
To 2 weeks	175 ± 14	100 ± 11	166 ± 13	99 ± 12
2 weeks	160 ± 16	90 ± 9	140 ± 10	85 ± 12
1 month	148 ± 10	86 ± 10	134 ± 11*	84 ± 11
3 months	138 ± 6	83 ± 11	140 ± 10	85 ± 11
6 months	134 ± 8	82 ± 8	132 ± 9	82 ± 6
12 months	133 ± 7##	82 ± 9##	130 ± 9#	81 ± 7

Note:

* $p < 0,05$, — in current indices inside the group AH + OA and IAH against baseline indices;

$p < 0,05$, ## $p < 0,01$ — between the indices in the groups on the corresponding stages of the investigation

Comorbidity of AH with OA influenced the baseline level of AP in patients with all types of OR of SAP and OR of DAP. SAP was more effectively controlled in patients with hypertensive than with hypotensive and isotensive types of OR of SAP.

DAP was more effectively controlled in the patients with hypertensive and hypotensive types of OR of SAP under AH + OA and with all types of OR of SAP under IAH. SAP was more effectively controlled in both groups of patients with hypertensive type of OR of SAP and DAP — in both groups of patients irrespective the type of OR of DAP. Comorbidity of AH with OA did not essentially influence the baseline level of AP under any type of DP of AP. The AP control efficacy was higher in patients with non-dipper DP of SAP, with dipper, non-dipper and over-dipper DP of DAP and lower — with dipper and night-peaker DP of SAP and night-peaker DP of DAP.

Corresponding to the analysis of the publications comorbidity of AH with OA occurs in 48–65 % cases [16], which is confirmed by the results of our investigation. We did not find any information about the investigation of AP efficacy control in the patients with AH + OA and IAH depending on DP of SAP and DP of DAP in the literature, thus, the results of our investigation are new. Moreover, as for the results, received by us the AP control was effective in both groups AH+OA and IAH, it occurred different for SAP and DAP and was connected with the types of DP of SAP and DP of DAP. More low

control efficacy of SAP in comparison with DAP can be explained by lower influence of antihypertension therapy on the level of DAP [17]. Identical control efficacy of SAP and DAP which should be taken into account in patients with non-dipper DP of SAP and lower of DAP — in dipper and night-peaker can be considered as different influence of DP of SAP on the chronobiology of SAP and DAP which is necessary to take into account during the patients management. Though control efficacy of SAP and DAP in patients with DP of DAP dipper, non-dipper, over-dipper and lower DAP — in night-peaker can be considered as more severe course of cormobid AH with OA and isolated AH with the data of DP of DAP which should be taking into account during the patients management.

CONCLUSIONS

1. Comorbid OA with AH in comparison with isolated one is characterized by high frequencies of more severe stages of AH and HF (15 %). The detrimental hypotensive type of OR of AP was found in 12 % in SAP in 15 % in DAP more frequent in patients with AH cormobid with OA than with isolated one.

The detrimental night-peaker DP occurred in 16 % in SAP, but non-dipper — in 20 % in DAP more frequent in patients with AH comorbid with OA than with isolated one. The comorbidity of AH with OA in patients with various types of OR and DP of AP did not authentically lower the indices of HRV but led to their reaction on orthostasis disruption.

2. Therapy in the way of standard schemes of antihypertensive preparations provided the AP effective control in patients with AH comorbid with OA with AP hypertensive type of OR with non-dipper DP of SAP and dipper, non-dipper and over-dipper DAP. Patients with hypotensive and isotensive types

of OR, dipper and night-peaker DP of SAP and night-peaker DAP need more intensive antihypertensive therapy. Adequate control of AP in patients with AH comorbid with OA promoted the improvement of HRV indices with proper reaction on orthostasis regeneration.

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