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Assessment of the 8-Year prognosis of fatal and non-fatal complications in patients with arterial hypertension combined with non-cardiological pathology

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Objective—to evaluate the 8-year prognosis of fatal and non-fatal complications in patients with arterial hypertension (AH) combined with non-cardiological pathology.

Materials and methods. This retrospective-prospective clinical study included 637 patients who were routinely hospitalized at the National Medical Research Center

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for Therapy and Preventive Medicine of the Ministry of Health of the Russian Federation for diagnostic procedures and adjustment of drug therapy. Inclusion criteria: men and women aged 40-80 years with AH (according to the Russian Society of Cardiology guidelines, 2024) without other cardiovascular diseases. The presence of other somatic diseases and risk factors for chronic non-communicable diseases was permitted. After 8 years of follow-up, telephone interviews were conducted with patients and their close relatives to record complications, including fatal and non-fatal cases. The response rate was 91.4%.

Results. Initially, patients with AH were divided into two groups depending on the number of additional non-cardiological diseases: AH combined with one non-cardiological disease and AH combined with two or more non-cardiological diseases. In the first group, all-cause death was registered in 13.3%, while in the second group, fatal outcomes were twice as high, amounting to 24.8% of cases (p = 0.001). All-cause mortality rates differed significantly between men and women in both groups. Cardiovascular death in the second group was registered in 15.8% of cases, and in the first group in 9.7% of cases. During the follow-up period, myocardial infarction was detected in 2.6% of cases in the first group and in 4.9% of patients in the second group. In the first group, stroke was registered in 3.6% of patients, and in the second group in 4.4% of patients. The majority of deceased patients from cardiovascular complications in the first group initially had stage 2 hypertension and high cardiovascular risk, whereas in the second group, this status was registered in every second deceased patient. In the second group, about 46% of deceased patients initially had stage 3 hypertension and very high cardiovascular risk.

Conclusion. Thus, over the 8-year follow-up period, in the group of patients with AH combined with two or more non-cardiological diseases, all-cause mortality was twice as high, and cardiovascular mortality was 1.5 times higher compared to the group of patients with AH combined with one non-cardiological disease. It is evident that when developing preventive programs, it is necessary to take into account not only the stages of AH, modifiable risk factors, and target organ damage, but also the presence of additional non-cardiological diseases, which collectively increase the risk of complications and fatal outcomes.

Keywords: arterial hypertension, fatal and non-fatal outcomes, 8-year prognosis, non-cardiological diseases.

Conflict of interest: none declared.

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Introduction

Arterial hypertension (AH) remains one of the pressing problems of modern medicine. Globally, its direct contribution to adult mortality is very significant. According to agestandardised data from 2022, among the causes of cardiovascular mortality, AH (16.1 cases per 100,000 population) ranks third after coronary heart disease (CHD) (108.8 cases per 100,000) and stroke (39.4 cases per 100,000). According to experts, the disabilityadjusted life years (DALYs) indicator for AH is 292.7 per 100,000 population, which is three times higher than the corresponding figures for atrial fibrillation [1].

AH is the most common cardiovascular disease worldwide, and Russia is no exception [2]. In the national populationbased study ESSERF3, the prevalence of AH was 44.8% in men and 33.9% in women (average 38.8%). Over recent years, the dynamics of AH prevalence have been insignificant, indicating the medical and social significance of this disease [3].

Experts agree that the high risk of cardiovascular complications and mortality is determined by a combination of the grade of AH, target organ damage, the presence of risk factors (RFs), and associated clinical conditions [4]. The developed scales for determining cardiovascular risk (CVR) and its gradations are determined by the severity of these parameters. In real clinical practice, patients with AH often have various somatic comorbidities. It is evident that comorbidity of somatic diseases in individuals with AH can affect both quality of life and prognosis [5, 6]. An increase in the number of concomitant diseases may also contribute to the development of overall complications in AH patients.

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Aim—to evaluate the 8-year prognosis of fatal and nonfatal complications in patients with AH combined with noncardiological pathology.

Materials and methods

In a retrospectiveprospective clinical study, medical records of 805 men and women hospitalised at the National Medical Research Centre for Therapy and Preventive Medicine of the Ministry of Health of Russia on a planned basis for diagnostic procedures and adjustment of drug therapy in 2016 were analysed.

Inclusion criteria: men and women aged 4080 years with a clinical diagnosis of AH grade 13 (Russian Society of Cardiology (RSC), 2024) without other cardiovascular diseases (CVD).

Exclusion criteria: age <40 or >80 years, presence of other CVD (CHD, cardiac arrhythmias, chronic heart failure (CHF), left ventricular aneurysm, cardiomyopathies, pulmonary hypertension, cerebrovascular disease, lower extremity atherosclerosis), severe somatic diseases in the decompensation stage at the time of hospitalisation, as well as mental disorders. Patients participating in various clinical trials were also excluded.

The study included 637 patients with RFs for chronic noncommunicable diseases and other somatic pathologies. A patient interview was conducted to identify sociodemographic indicators, family history, and behavioural RFs. AH stages and CVR gradations were determined according to the 2024 clinical guidelines "Arterial Hypertension in Adults" of the RSC [4].

Somatic diseases were recorded based on medical documentation (discharge summaries and results of clinical, instrumental, and laboratory examinations). Patients underwent standard examinations (blood pressure measurement, heart rate, resting electrocardiography, echocardiography, complete blood count, urinalysis, lipid profile assessment, fasting glucose, creatinine, uric acid and electrolytes), as well as additional instrumental and laboratory tests when necessary.

After 8 years of followup, telephone interviews were conducted with patients and their close relatives to record the development of complications, including allcause death, cardiovascular death, myocardial infarction (MI), acute cerebrovascular accident (ACVA), and coronary revascularisation.

The study protocol and medical documentation forms were approved by the independent local ethics committee in 2026.

Statistical analysis

Statistical analysis was performed using R 4.2.3. Qualitative data are presented as proportions and percentages. Differences between two independent samples for continuous variables were assessed using the MannWhitney U test, and for categorical variables using Fisher's exact test. Differences with $p < 0.05$ were considered statistically significant.

Results

Depending on the number of additional noncardiological diseases, patients with AH were divided into two groups. Noncardiological pathologies included: bronchopulmonary diseases, type 2 diabetes mellitus (T2DM), chronic gastrointestinal diseases, urogenital diseases, and thyroid diseases.

The first group comprised patients with AH combined with one noncardiological disease, and the second group comprised patients with two or more noncardiological diseases. The number of patients in the second group was twice as large as in the first group (n = 423, 66.4% and n = 214, 33.6%, respectively). The gender composition between the groups was also comparable (Table 1). In both groups, stage 2 hypertension predominated; its frequency in the first group was significantly higher than in the second group. The frequency of stage 3 hypertension in the

Table 1. **Agesex characteristics and clinical status of patients with AH**

Parameter	Group of AH patients with one noncardiological disease, n = 214	Group of AH patients with two or more noncardiological diseases, n = 423	Significance, p
Mean age, years	59.9±11.5	62.87±10.39	0.002
Men	91 (42.5 %)	162 (38.3 %)	0.305
Women	123 (57.5 %)	261 (61.7 %)	0.305
Stage 1 hypertension	21 (9.8%)	23 (5.4%)	0.047
Stage 2 hypertension	164 (76.6 %)	277 (65.5 %)	0.0048
Stage 3 hypertension	29 (13.5 %)	123 (29.1 %)	<0.0001

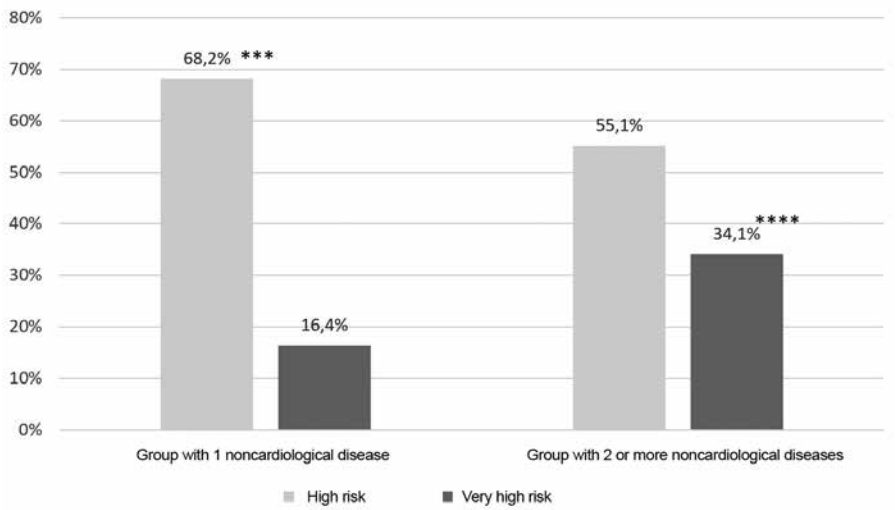

Fig. 1. Would be inserted here – description: Frequency of high and very high CVR in patients with AH combined with noncardiological diseases
Note. ***p < 0.001, ****p < 0.0001 for betweengroup differences.

second group was twice as high as in the first group. Consequently, in the cohort of stage 1 hypertension, up to 10% of cases were verified.

Analysis of different gradations of total CVR in groups with different numbers of additional somatic diseases demonstrated that in the second group, initially every second patient had high CVR, while in the first group high risk was registered in about 70% of cases (Fig. 1). Very high risk in the second group was identified in every third patient, while in the first group its frequency was half as low. The difference between groups was statistically significant (p < 0.0001). Overall, about 85% in the first group and 90% in the second group of individuals with AH during the examination in 2016 had high and very high CVR.

Analysis of the 8 year prognosis for the development of complications demonstrates that in the group of patients with AH combined with one noncardiological disease, allcause death was registered in 13.3%, while in the group with two or more noncardiological diseases, fatal outcomes were twice as frequent, accounting for 24.8% of cases (p < 0.001). This pattern was observed both in men and women (Table 2). Cardiovascular death was also 1.5 times more frequent in the second group compared to the first (15.8% and 9.7%, respectively).

During the followup period, MI developed in 2.6% of patients in the first group and in 4.9% in the second group. A similar trend was found for ACVA: in the first group, ACVA was registered in 3.6%, and in the

Table 2. **Fatal and nonfatal complications in individuals with AH combined with noncardiological pathology**

Endpoints	Group of AH patients with one noncardiological disease, n = 195 (83 men, 112 women)	Group of AH patients with two or more noncardiological diseases, n = 387 (152 men, 235 women)	Significance, p
Allcause death, total	26 (13.3%)	96 (24.8%)	0.0012
Men	10 (12%)	34 (22.4%)	0.0561
Women	16 (14.3%)	62 (26.4%)	0.0130
Cardiovascular death, total	19 (9.7%)	61 (15.8%)	0.0553
Men	8 (9.6%)	22 (14.5%)	0.3153
Women	11 (9.8%)	39 (16.6%)	0.1037
MI, total	5 (2.6%)	19 (4.9%)	0.269
Men	2 (2.4%)	7 (4.6%)	0.499
Women	3 (2.7%)	12 (5.1%)	0.403
ACVA, total	7 (3.6%)	17 (4.4%)	0.8257
Men	3 (3.6%)	6(3.9%)	1.000
Women	4 (3.6%)	11 (4.7%)	0.7817
Coronary revascularisation, total	9 (4.6%)	27 (7%)	0.362
Men	5 (6%)	15 (9.9%)	0.464
Woman	4 (3.6%)	12 (5.1%)	0.597

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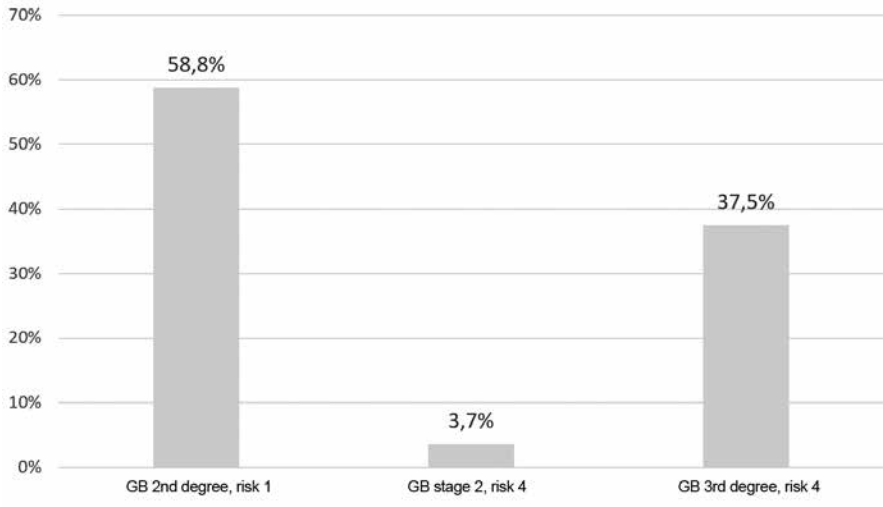

Fig. 2. Would be inserted here – description: Baseline CVR and AH stages among patients with fatal CVD outcomes (n = 80)

second group—in 4.4% of cases. It should be noted that the incidences of MI and ACVA between groups, as well as by gender, did not show statistically significant differences.

In the cohort, coronary revascularisation was performed in up to 10% of cases; in the second group its frequency was 1.5 times higher compared to the first group, but without statistical significance.

Within the study, the association between cardiovascular mortality and baseline CVR was analysed. Overall, in the examined cohort, among individuals with fatal cardiovascular outcomes, initially every second patient had stage 2 hypertension and high CVR. About 40% of patients who died from CVD had initially stage 3 hypertension and very high CVR, and only 3.7% of deceased patients initially had stage 2 hypertension and very high CVR (Fig. 2).

Table 3 presents data on baseline CVR in groups with different numbers of noncardiological pathologies among patients with fatal complications.

Most patients who died from cardiovascular events in the first group initially had stage 2 hypertension and high CVR; in the second group, a similar level of CVR and hypertension stage was found in every second deceased patient. In the second group, about 46% of patients who died from CVD initially had stage 3 hypertension and very high CVR, whereas in the first group only every tenth deceased patient initially had stage 3 hypertension and very high CVR. The differences between the groups were statistically significant (p = 0.0061). Stage 2 hypertension and very high CVR were identified in 10.5% of patients who died from CVD in the first group. A similar indicator in the second group was found in one deceased patient.

Discussion

The retroprospective study was aimed at evaluating the 8 year prognosis of middleaged patients with AH without other CVD. Overall, a varying frequency of noncardiological diseases was found in the AH cohort. The most common were: obesity, nonalcoholic fatty liver disease (NAFLD), chronic obstructive pulmonary disease (COPD), chronic gastroduodenitis, type 2 diabetes mellitus, and chronic kidney disease. Chronic diseases such as varicose veins of the lower extremities, hypothyroidism/nodular goitre, and eye diseases were verified in every sixthseventh patient with AH.

In this study, the tracking of endpoints was performed taking into account the presence of additional

Table 3. **Analysis of baseline clinical status in the group with cardiovascular mortality**

Hypertension stage	Cardiovascular mortality in group with one noncardiological disease, n = 19	Cardiovascular mortality in group with two or more noncardiological diseases, n = 61	Significance, p
Stage 2, risk 3	15 (79%)	32 (52.5%)	0.0608
Stage 2, risk 4	2 (10.5%)	1 (1.6%)	0.1388
Stage 3, risk 4	2 (10.5%)	28 (45.9%)	0.0061

noncardiological diseases. For this purpose, patients were conventionally divided into two groups regardless of the presence of a specific somatic disease.

In real clinical practice, AH is often combined with other somatic diseases. A study involving 67,385 patients with AH from primary care institutions in Canada found that at a mean age of 70 years, 80.6% had concomitant diseases [7].

In the literature, when analysing multimorbidity in patients with AH, cardiometabolic disorders are primarily considered [8, 9]. For example, an analysis of the comorbidity structure of chronic diseases among the German population aged 40 years and older (6,554 individuals, mean age 62.0 years) showed that 53.3% of participants had combined pathology in various combinations, with the group with hypertension and metabolic diseases accounting for 21.7% [10].

As a rule, some cardiometabolic disorders have been considered as additional RFs for the development of complications in AH [4].

In our study, NAFLD was one of the most common somatic diseases in patients with AH. Experts agree that AH and NAFLD are interrelated independently of other components of the metabolic syndrome, such as obesity and T2DM. Clinical data indicate that NAFLD is associated with incident AH, while elevated blood pressure is associated with the development of NAFLD and possible subsequent progression to liver fibrosis. Insulin resistance and activation of the reninangiotensinaldosterone system may provide potential pathophysiological links between these clinical conditions [11].

In the NHANES project involving 3,144 patients, it was shown that hypertension was positively associated with the risk of NAFLD (odds ratio = 1.677; 95% confidence interval (CI) 1.1592.423). Systolic blood pressure (≥130 mm Hg) and diastolic blood pressure ≥ 80 mm Hg were also significantly positively associated with NAFLD. Moreover, hypertension was independently associated with hepatic steatosis (β = 7.836; 95% CI 2.33413.338). Results from Mendelian randomisation analysis also confirmed a causal relationship between hypertension (relative risk = 7.203 [95% CI 2.29722.587]) and NAFLD [12].

Another important somatic disease combined with AH is COPD, which was found in every fifth patient in the examined cohort. According to data from the Russian National Registry of AH, cardiovascular (CHD, myocardial infarction, CHF, peripheral artery atherosclerosis) and cerebrovascular (stroke/transient ischaemic attack) diseases are more frequently diagnosed in patients with AH and COPD. The analysed sample included 32,571 patients with AH followed up in primary care institutions, with a mean age of 64 ± 7 years (64% women); COPD was diagnosed in 5.4% of patients with AH. The study showed that male sex and age are the strongest independent factors influencing the risk of CVD in these patients. COPD significantly increases the risk of developing CHF [13].

In the present study, the mean age in the group with two or more noncardiological diseases was 3 years higher, which obviously also contributed to the development of fatal complications. At the same time, the gender composition was comparable between the groups.

Nonfatal complications individually did not differ significantly between the groups (the combined frequency of MI and stroke in the first group was 6.2%, in the second – 9.3%), whereas in the group with two or more noncardiological diseases, a significantly higher frequency of allcause mortality and cardiovascular death was registered compared to the group with one noncardiological disease. In the second group, almost every second patient who died from cardiovascular complications initially had stage 3 hypertension and very high CVR. About 80% of patients who died from cardiovascular complications in the first group and every second deceased patient in the second group initially had stage 2 hypertension and high CVR. It is obvious that, along with patients with very high CVR, patients with stage 2 hypertension and high CVR should be under medical supervision.

Conclusion

Thus, over 8 years of followup, in the group of patients with AH combined with two or more noncardiological diseases, allcause death was twice as frequent, and cardiovascular death was 1.5 times more frequent compared to the group with AH combined with one noncardiological disease. Obviously, when developing preventive programmes, it is necessary to consider not only the grade of AH, modifiable RFs, and target organ damage, but also the presence of additional noncardiological diseases, which together increase the risk of complications and fatal outcomes.

Conflict of interest: none declared.

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