

Evaluation 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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Aim. 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 for Therapy and Preventive Medicine for diagnostic procedures and adjustment of drug therapy. Inclusion criteria: men and women aged 40–80 years with a clinical diag-

nosis of hypertension stages 1–3 (Russian Cardiological Society, 2024) without other cardiovascular diseases. The presence of other somatic diseases and risk factors for chronic non-communicable diseases was allowed. After 8 years of follow-up, telephone interviews were conducted with patients and their close relatives to record complications, including fatal and non-fatal events. The response rate was 91.4%.

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Results. At baseline, patients with AH were divided into two groups according to 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, accounting for 24.5% of cases ($p = 0.002$). Cardiovascular death was also more frequently detected in the second group compared to the first group (15.5% and 9.7%, respectively), although the difference did not reach statistical significance ($p = 0.072$). During the follow-up period, myocardial infarction in the first group was registered in 2.6% of cases, and in the second group—in 4.1% of patients. A similar trend was observed for acute cerebrovascular accident (ACVA). Thus, in the first group, ACVA was registered in 3.1% of patients, in the second group—in 5.2% 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 recorded in every second deceased patient. In the second group, about 47 % of deceased patients initially had stage 3 hypertension and very high cardiovascular risk.

Conclusion. Thus, over 8 years of follow-up, all-cause death and cardiovascular death in the group with AH com-

bined with two or more non-cardiological diseases were twice as high compared to the group 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 stage 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.

Received: 22.06.2026

Accepted: 04.08.2026



For citation: Karimov AK, Mamedov MN, Chernyshenko EG et al. Evaluation of the 8-year prognosis of fatal and non-fatal complications in patients with hypertensive disease combined with non-cardiological pathology. International Heart and Vascular Disease Journal. 2026; 14(51):4-10. DOI: 10.24412/2311-1623-2026-51-5-13

Introduction

Arterial hypertension (AH) remains one of the pressing problems of modern medicine. Globally, its direct contribution to adult mortality is very significant. Thus, according to age-standardized data from 2022, among the causes of cardiovascular mortality, AH (16.1 cases per 100,000 people) ranks third after ischemic heart disease (IHD) (108.8 cases per 100,000 people) and stroke (39.4 cases per 100,000 people). According to experts, the indicator assessing the overall “burden of disease” in the population (DALYs) for AH is 292.7 units per 100,000 population, which is three times higher than similar indicators for atrial fibrillation [1].

AH is the most common disease of the cardiovascular system worldwide, and Russia is no exception [2]. In the national population-based study ESSE-RF 3, the prevalence of AH among men was 44.8%, and among women 33.9% (average—38.8%). In recent years, changes in the prevalence of AH have been insignificant, which indicates the medical and social significance of this disease [3].

Experts agreed that the high risk of cardiovascular complications and mortality is due to a combination of the degree 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 grades are determined by the severity of these indicators. In real clinical practice, various somatic diseases are often encountered among patients with AH. It is obvious 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 combined complications in patients with AH.

The aim of this study was to assess the 8-year prognosis of fatal and nonfatal complications in patients with AH in combination with non-cardiac pathology.

Materials and methods

In a retrospective-prospective clinical study, we analyzed the medical records of 805 men and women

admitted electively to the National Medical Research Center for Therapy and Preventive Medicine in 2016 for diagnostic procedures and adjustment of drug therapy.

Inclusion criteria: men and women aged 40–80 years with a clinical diagnosis of hypertensive disease stages 1–3 (Russian Society of Cardiology (RSC), 2024) without other cardiovascular diseases (CVDs). Exclusion criteria were: age under 40 and over 80 years; presence of other CVDs (ischemic heart disease (IHD), cardiac arrhythmias, chronic heart failure (CHF), left ventricular aneurysm, cardiomyopathy, pulmonary hypertension, cerebrovascular disease, lower extremity atherosclerosis); severe somatic diseases in the decompensation stage at the time of hospitalization; and mental disorders. Patients participating in various clinical trials were excluded.

The study included 637 patients with risk factors (RFs) for chronic noncommunicable diseases and other somatic pathologies. A patient survey was conducted to identify sociodemographic indicators, family history, and behavioral RFs. AH stages and CVR grades were determined according to the 2024 RSC clinical guidelines “Arterial Hypertension in Adults” [4].

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

After 8 years of follow-up, telephone interviews were conducted with patients and their close relatives to record the development of complications, including all-cause death, cardiovascular death, myocardial infarction (MI), acute cerebrovascular accident (ACVA),

and coronary revascularization. The response rate was 91.4%.

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

Statistical analysis

Statistical analysis was performed in the R 4.2.3 data analysis environment. Qualitative data are presented as proportions and percentages. Differences between two independent samples for continuous variables were assessed using the Mann–Whitney 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 non-cardiological diseases, patients with AH were divided into two groups. Non-cardiological pathologies included: diseases of the bronchopulmonary system, type 2 diabetes mellitus (DM), chronic diseases of the gastrointestinal tract, genitourinary system, and thyroid gland.

The first group included patients with AH in combination with one non-cardiological disease; the second group included those with two or more non-cardiological diseases. The number of patients in the second group was twice as high 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 compared with the second group. The frequency of stage 3 hypertension in the second group was twice as high as in the first group. Consequently, in the cohort, stage 1 hypertension was verified in up to 10% of cases.

Analysis of different gradations of total CVR in groups of individuals with different numbers

Table 1. Sex and age indicators and clinical status of patients with AH

Indicator	Group of AH patients with one non-cardiological disease, n = 214	Group of AH patients with two or more non-cardiological diseases, n = 423	Significance of difference, p
Mean age, years	59.9±11.5	62.87±10.39	0.0026
Men	91 [42.5 %]	162 [38.3 %]	0.305
Woman	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 [13.6 %]	123 [29.1 %]	<0.001

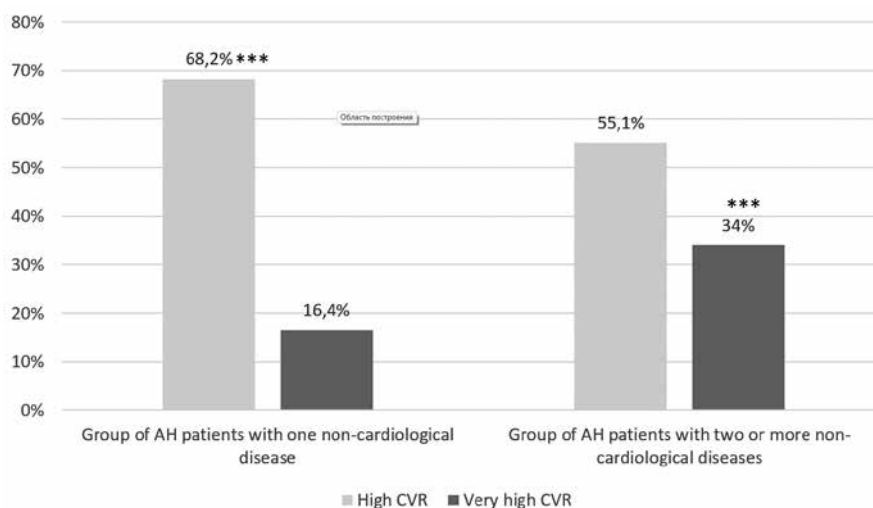


Fig. 1. Frequency of high and very high CVR in patients with AH in combination with non-cardiological diseases.

Note. ***p <0.001 – significance of difference between groups.

of additional somatic diseases demonstrated that in the second group, initially every second patient had high CVR; in the first group, high risk was registered in about 70% of cases (Fig. 1). Very high risk in the second group was detected in every third patient; in the first group, its frequency was two times lower. The difference between the groups is statistically significant (p<0.001). Overall, about 85% in the first group and about 90% in the second group of individuals with AH in 2016 during examination 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 in combination with one non-cardiological disease, all-cause death was registered

in 13.3%; in the group of patients with a combination of two or more non-cardiological diseases, fatal outcomes were recorded twice as often and amounted to 24.5% of cases. This pattern is observed in both men and women (Table 2). Cardiovascular death was also more frequently detected in the second group compared with the first group (15.5% and 9.7%, respectively), but the difference did not reach statistical significance.

During the follow-up period, MI developed in 2.6% of patients in the first group and in 4.1% of patients in the second group. A similar trend was found for the development of ACVA. Thus, in the first group, ACVA was registered in 3.1%, and in the second group in 5.2% of cases. It should be noted that the incidents

Table 2. Fatal and nonfatal complications in individuals with AH in combination with non-cardiological pathology

Endpoints	Group of AH patients with one non-cardiological disease, n = 195 (83 men, 112 women)	Group of AH patients with two or more non-cardiological diseases, n = 387 (144 men, 243 women)	Significance of difference, p
All-cause death, total	26 (13.3 %)	95 (24.5 %)	0.0016
Men	10 (12 %)	34 (23.6 %)	0.0371
Woman	16 (14.3 %)	61 (25.1 %)	0.0262
Cardiovascular death, total	19 (9.7 %)	60 (15.5 %)	0.0720
Men	8 (9.6 %)	22 (15.3 %)	0.3091
Woman	11 (9.8 %)	38 (15.6 %)	0.1848
MI, total	5 (2.6 %)	16 (4.1 %)	0.4806
Men	2 (2.4 %)	6 (4.2 %)	0.7137
Woman	3 (2.7 %)	10 (4.1 %)	0.7620
ACVA, total	6 (3.1 %)	20 (5.2 %)	0.2935
Men	3 (3.6 %)	7 (4.9 %)	0.7499
Woman	3 (2.7 %)	13 (5.3 %)	0.4090
Coronary revascularization, total	9 (4.6 %)	25 (6.5%)	0.4556
Men	5 (6 %)	12 (8.3%)	0.6088
Woman	4 (3.6%)	13 (5.3 %)	0.5975

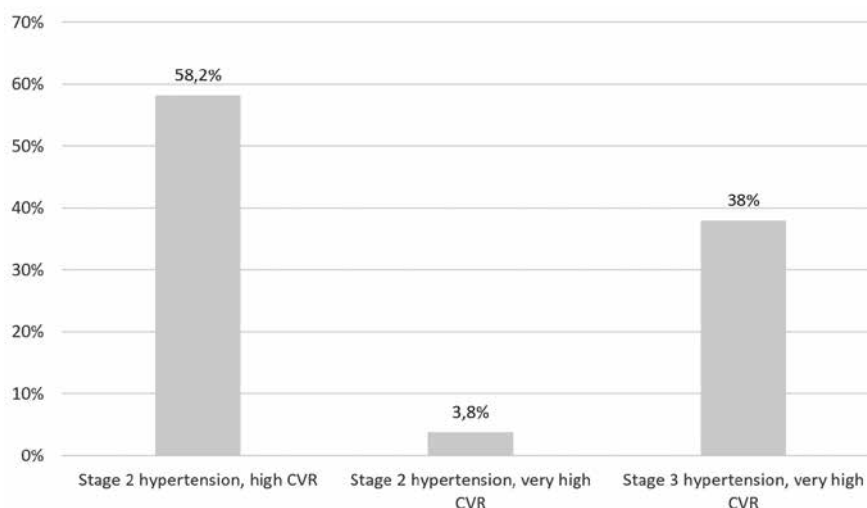


Fig. 2. Baseline CVR level and hypertension stages among patients with fatal outcome, (n=79)

of MI and ACVA between the groups, as well as by gender, do not have statistically significant differences.

In the cohort, coronary revascularization was performed in up to 10% of cases; in the second group, its frequency was 1.4 times higher compared with the first group, without statistical difference.

Within the study, the association between cardiovascular mortality and baseline CVR was analyzed. Overall, in the examined cohort, among individuals with fatal cases from cardiovascular complications, initially every second patient had stage 2 hypertension and high CVR. About 40% of patients who died from cardiovascular diseases initially had stage 3 hypertension and very high CVR, and 3.8% of deceased patients initially had stage 2 hypertension and very high CVR (Fig. 2).

Table 3 presents data on the baseline CVR level in groups of individuals with different numbers of non-cardiological pathologies and fatal complications.

The majority of deceased patients from cardiovascular complications in the first group initially had stage 2 hypertension and high CVR; in the second group, a similar CVR level and hypertension stage was detected in every second deceased patient. In the second group, about 47% of patients

who died from cardiovascular complications initially had stage 3 hypertension and very high CVR, while in the first group only every tenth patient who died from cardiovascular complications initially had stage 3 hypertension and very high CVR. The differences between the groups are statistically significant ($p = 0.0059$). Stage 2 hypertension and very high CVR were detected in 10.5% of deceased patients from cardiovascular complications in the first group. The analogous indicator in the second group was detected in one deceased patient.

Discussion

This retrospective-prospective study was devoted to assessing the 8-year prognosis of middle-aged patients with AH without other CVDs. Overall, in the cohort of patients with AH, varying frequencies of non-cardiological diseases were identified. Obesity was most frequently recorded; in the overall cohort, its frequency was 35.2%. Non-alcoholic fatty liver disease (NAFLD) was diagnosed in 23% of patients with AH. Chronic obstructive pulmonary disease (COPD) and chronic gastroduodenitis were detected in more than 21% of cases. Such chronic diseases as type 2 DM, varicose veins of the lower extremities, hypothyroidism/nodular goiter, and diseases of the visual

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

Hypertension stage and CVR	Cardiovascular mortality in the group with one non-cardiological disease, n = 19	Cardiovascular mortality in the group with two or more non-cardiological diseases, n = 60	Significance of difference, p
Stage 2 hypertension, risk 3	15 (78.9%)	31 (51.7%)	0.0600
Stage 2 hypertension, risk 4	2 (10.5%)	1 (1.7%)	0.1420
Stage 3 hypertension, risk 4	2 (10.5%)	28 (46.7%)	0.0059

organs were verified in every sixth patient with AH. Other somatic diseases were registered in less than 10% of cases. In the present study, follow-up of endpoints was performed taking into account the presence of additional non-cardiological diseases. For this purpose, patients were conditionally 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. In a study involving 67,385 patients with AH from primary care institutions in Canada, it was found that at a mean age of 70 years, 80.6% had concomitant diseases [7].

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

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

In our study, NAFLD turned out to be one of the common somatic diseases in patients with AH. Experts agreed that AH and NAFLD are interrelated independently of other components of the metabolic syndrome, such as obesity and DM. Clinical data show that NAFLD is associated with newly onset AH, whereas elevated BP is associated with the development of NAFLD and possible subsequent progression to liver fibrosis. Insulin resistance and activation of the renin-angiotensin-aldosterone system may provide potential pathophysiological links between these clinical conditions [11].

Within the NHANES project involving 3,144 patients, it was shown that hypertension is positively associated with the risk of NAFLD (odds ratio = 1.677; 95% confidence interval (CI), 1.159–2.423). Systolic BP (≥ 130 mm Hg) and diastolic BP ≥ 80 mm Hg were also significantly positively associated with NAFLD. In addition, hypertension was independently associated with hepatic steatosis ($\beta = 7.836$ [95% CI, 2.334–13.338]). The results of Mendelian randomization analysis also confirmed a causal relationship between hypertension (relative risk = 7.203 [95% CI, 2.297–22.587]) and NAFLD [12].

Another important somatic disease combined with AH is COPD, which was detected in every fifth patient in the examined cohort. According to data from the Russian National Registry of AH, cardiovascular (IHD, myocardial infarction, CHF, peripheral artery atherosclerosis) and cerebrovascular (stroke/transient ischemic attack) diseases are more often diagnosed in patients with AH and COPD. The analyzed sample included 32,571 patients with AH observed in primary care institutions, whose mean age was 64 ± 7 years (64% of them women); 5.4% of patients with AH were diagnosed with COPD. 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 CHF [13].

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

Nonfatal complications individually did not differ significantly between the groups (the total frequency of MI and stroke in the first group was 6.2%, in the second group—9.3%), whereas in the group of individuals with two or more non-cardiological diseases, a significantly higher frequency of all-cause mortality was registered compared with the group of individuals with one non-cardiological disease. The difference in cardiovascular mortality between the groups did not reach statistical significance, which may be due to the small number of events. In the second group, among those who died from cardiovascular complications, 48.3% initially had very high CVR. In the group of deceased patients with one non-cardiological disease, only 21% initially had 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 follow-up, in the group of patients with AH in combination with two or more non-cardiological diseases, all-cause death was twice as high compared with the group of individuals

with AH in combination with one non-cardiological disease. It is obvious that when developing preventive programs, it is necessary to take into account not only the degrees of AH, modifiable RFs, and target organ damage, but also the presence of additional non-car-

diological diseases, which together increase the risk of complications and fatal cases.

Conflict of Interest: none declared.

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