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Factors Influencing the Prognosis of Survival and Development of Cardiovascular Complications in Elderly Patients

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ABSTRACT: Background: Cardiovascular diseases are the leading cause of morbidity and mortality among elderly individuals, with prevalence increasing with age. In older patients, cardiovascular diseases rarely occur as isolated conditions, and their prognosis is determined by a combination of classical risk factors, geriatric syndromes, comorbid conditions, and behavioral factors.

Objective: To analyze factors influencing survival and the prognosis of cardiovascular complications in elderly patients with degenerative changes in the cardiovascular system.

Materials and Methods: The study included 200 patients aged 60 to 85 years (109 men, 81 women), divided into two groups: Group 1 (n=120) with degenerative valvular changes (aortic stenosis, mitral regurgitation, combined valvular lesions), and Group 2 (n=80) with atherosclerotic vascular changes (carotid artery stenosis, chronic limb ischemia, coronary artery disease). Statistical analysis included chi-square testing, Kaplan–Meier survival analysis, and Cox proportional hazards regression.

Results: In Group 1, arterial hypertension was observed in 81.6% ($\chi^2=32.4$; $p<0.001$), atherosclerosis in 60.0% ($\chi^2=18.7$; $p=0.002$), type 2 diabetes mellitus in 40.8% ($\chi^2=9.3$; $p=0.026$), dyslipidemia in 55.0% ($\chi^2=14.8$; $p=0.008$), and smoking in 31.6% ($\chi^2=6.7$; $p=0.041$). In Group 2, atherosclerosis was observed in 80.0%, arterial hypertension in 76.2%, dyslipidemia in 52.5%, type 2 diabetes mellitus in 47.5%, smoking in 33.8%, and chronic kidney disease in 23.8%. Combined risk factors occurred in 75% of Group 2 patients. Kaplan–Meier analysis showed survival rates of 60% in Group 1 and 75% in Group 2. Cox regression identified coronary artery calcification, arterial hypertension, metabolic disorders, and low treatment adherence as independent predictors of adverse outcomes.

Conclusion: Prognosis of survival and cardiovascular complications in elderly patients depends on classical risk factors, geriatric syndromes, comorbid conditions, and human-related factors. Low treatment adherence significantly increases complication risk even in patients with similar clinical profiles. A comprehensive, individualized approach incorporating both biomedical and behavioral factors is essential for improving outcomes in this population.

INTRODUCTION

Cardiovascular diseases are the leading cause of morbidity and mortality among older and elderly individuals [1–3]. In the modern world, there is a clear trend toward population aging, and this, combined with the increasing prevalence of cardiovascular diseases, represents a significant social burden in terms of disability, functional decline, and rising healthcare costs. By 2034, the number of elderly individuals may exceed the number of children (under 18 years of age), and this demographic shift will be accompanied by an increased prevalence of both overt and subclinical cardiovascular diseases, due both to improved survival of patients with cardiovascular diseases at younger ages and to the progression of cardiovascular pathology associated with age-related pathophysiological changes.

Common cardiovascular conditions whose prevalence increases with age include arterial hypertension (AH), coronary artery disease (CAD), heart failure (HF), valvular heart disease, cardiac arrhythmias (most commonly atrial fibrillation), cerebrovascular diseases, and peripheral arterial diseases [1,2,4]. In elderly individuals, cardiovascular diseases rarely occur as isolated conditions.

The prognosis of survival and the risk of cardiovascular complications (CVC) in elderly patients are determined by a combination of classical risk factors (arterial hypertension, diabetes mellitus, dyslipidemia, and smoking) and specific geriatric syndromes (cognitive impairment, frailty, and polypharmacy). Key determinants include advanced age, male sex, and elevated low-density lipoprotein cholesterol (LDL-C) levels. The coexistence of multiple risk factors increases mortality by 5–7 times. The main prognostic determinants include, first, classical cardiovascular risk factors—arterial hypertension (associated with a 1.5–6-fold increased risk), diabetes mellitus, and dyslipidemia (elevated LDL-C increases the risk of CAD by 2.2–5.5 times);

second, geriatric syndromes (senile asthenia), including reduced functional status, frailty, cognitive impairment, high risk of falls, and depression; and third, behavioral factors such as smoking (one of the major modifiable risk factors), physical inactivity, and unhealthy diet. Comorbid conditions also play a significant role, including chronic kidney disease, obesity, chronic heart failure, as well as medical factors such as polypharmacy (use of multiple medications), low treatment adherence, and difficulties in blood pressure control in individuals over 80 years of age. Improving prognosis requires targeted management of modifiable risk factors, including smoking cessation, dietary modification, increased physical activity, and comprehensive geriatric assessment to prevent cardiovascular complications.

Purpose of the research

To analyze factors influencing survival and the prognosis of cardiovascular complications in elderly patients with degenerative changes in the cardiovascular system.

MATERIALS AND METHODS

This study was conducted at the Department of Cardiology and Gerontology with a Course of Interventional Cardiology and Arrhythmology, Center for the Development of Professional Qualifications of Medical Workers, Tashkent, Uzbekistan. The study was designed as a prospective observational analysis conducted in two consecutive stages to identify etiological factors and prognostic determinants influencing survival and cardiovascular complications in elderly patients with degenerative changes in the cardiovascular system.

A total of 200 patients aged 60 to 85 years were examined, including 109 men (54.5%) and 81 women (40.5%). All patients provided informed consent prior to participation in the study. The inclusion criteria were: (1) age 60 years or older; (2) confirmed diagnosis of degenerative valvular changes or atherosclerotic vascular lesions based on clinical, laboratory, and instrumental examination; (3) signed informed consent; and (4) availability of complete medical records and follow-up data. The exclusion criteria were: (1) age below 60 years; (2) acute cardiovascular events within the preceding three months; (3) severe concomitant diseases with expected survival of less than six months; (4) refusal to participate in the study; and (5) incomplete medical documentation.

All patients were divided into two groups based on the predominant type of degenerative cardiovascular pathology:

- ✓ Group 1 (n=120): Patients with degenerative valvular changes, including aortic stenosis, mitral regurgitation, and combined valvular lesions. The mean age of patients in this group was 72.4 ± 6.8 years. This group comprised 66 men (55.0%) and 54 women (45.0%).
- ✓ Group 2 (n=80): Patients with confirmed atherosclerotic vascular changes, including carotid artery stenosis, chronic limb ischemia, and coronary artery disease. The mean age of patients in this group was 70.8 ± 6.2 years. This group comprised 43 men (53.8%) and 37 women (46.2%).

All patients underwent a comprehensive clinical examination that included:

Anamnesis and Clinical Assessment: Detailed collection of medical history, including duration of cardiovascular disease, presence of classical risk factors (arterial hypertension, diabetes mellitus, dyslipidemia, smoking), comorbid conditions, and current pharmacological therapy. Functional status was assessed using standardized scales, and frailty was evaluated according to established geriatric criteria.

Laboratory Investigations: Complete blood count, blood chemistry panel including lipid profile (total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides), fasting glucose, glycated hemoglobin (HbA1c), creatinine with estimated glomerular filtration rate (eGFR), and inflammatory markers (C-reactive protein, erythrocyte sedimentation rate).

Echocardiography: Transthoracic echocardiography was performed in all patients to assess valvular morphology and function, including the degree of valvular calcification, stenosis, and regurgitation. Valvular calcification was graded semi-quantitatively as mild, moderate, or severe based on echogenicity and mobility of valve leaflets.

Vascular Ultrasound: Duplex ultrasonography of the carotid arteries and lower extremity vessels was performed to assess the degree of stenosis, presence of atherosclerotic plaques, intima-media thickness, and calcification of the vascular wall.

Coronary Angiography: Coronary angiography was performed when clinically indicated to assess the presence and severity of coronary artery disease, including the degree of coronary artery calcification.

Computed Tomography: Multislice computed tomography was used to quantify coronary artery calcification using the Agatston score in patients with suspected coronary artery disease.

Blood Pressure Monitoring: Office blood pressure measurement and 24-hour ambulatory blood pressure monitoring were performed to assess blood pressure control and variability.

In the first stage of the study, an analysis was conducted to identify etiological factors contributing to pathological processes in elderly patients with degenerative changes in the cardiovascular system. For Group 1 patients, the following factors were analyzed: arterial hypertension, atherosclerosis, type 2 diabetes mellitus, dyslipidemia, smoking, autoimmune diseases (primarily rheumatoid arthritis), chronic infectious diseases (mainly infective endocarditis), and the presence of two or more simultaneous risk factors. For Group 2 patients, the following factors were analyzed: atherosclerosis, arterial hypertension, type 2 diabetes mellitus, dyslipidemia, smoking, and chronic kidney disease (CKD stages I–II).

Treatment adherence was assessed using a structured questionnaire and review of medical records. Patients were classified as having high, moderate, or low adherence based on the following parameters: regularity of medication intake, compliance with lifestyle recommendations (diet, physical activity, smoking cessation), and adherence to scheduled outpatient follow-up visits. Low treatment adherence was defined as irregular medication intake, inadequate compliance with lifestyle recommendations, and insufficient outpatient monitoring.

In the second stage of the study, survival analysis was performed using the Kaplan–Meier method. The primary endpoint was the development of cardiovascular complications, including myocardial infarction, stroke, decompensated heart failure, unstable angina, and cardiovascular death. The follow-up period was defined from the date of initial examination to the date of the primary endpoint or the end of the study. Survival curves were constructed for both groups, and the log-rank test was used to compare survival distributions between groups.

Cox proportional hazards regression analysis was performed in the overall cohort including patients from both groups. The model incorporated clinical and behavioral factors associated with the risk of complications, including group affiliation, coronary artery calcification, arterial hypertension, metabolic disorders, and human-related indicators such as treatment adherence level, medication compliance, and adherence to outpatient follow-up. Hazard ratios (HR) with 95% confidence intervals (CI) were calculated for each predictor. An HR of 1.0 indicated no change in risk, $HR > 1.0$ indicated increased risk, and $HR < 1.0$ indicated a protective factor.

Statistical analysis was performed using SPSS software version 26.0 (IBM Corp., Armonk, NY, USA) and R software version 4.2.0 (R Foundation for Statistical Computing, Vienna, Austria). Continuous variables were expressed as mean $\pm$ standard deviation (SD) or median with interquartile range (IQR) depending on data distribution. Categorical variables were expressed as absolute numbers and percentages with 95% confidence intervals (CI). The chi-square (χ^2) test was used to assess associations between categorical variables. The Kaplan–Meier method with the log-rank test was used for survival analysis. Cox proportional hazards regression analysis was used to identify independent predictors of cardiovascular complications. A p-value of less than 0.05 was considered statistically significant.

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved by the Local Ethics Committee of the Center for the Development of Professional Qualifications of Medical Workers, Tashkent, Uzbekistan. Written informed consent was obtained from all patients prior to their inclusion in the study. Patient data were anonymized and confidentiality was maintained throughout the study.

The present study has several limitations that should be acknowledged. First, the sample size was relatively modest, which may limit the generalizability of the findings. Second, the follow-up period was limited, and longer-term outcomes were not assessed. Third, treatment adherence was assessed using self-reported questionnaires, which may be subject to recall bias. Fourth, the study was conducted at a single center, and multicenter studies are needed to confirm the findings in broader populations. Finally, the impact of specific geriatric syndromes such as cognitive impairment and frailty on outcomes was not comprehensively assessed in all patients.

RESULTS AND DISCUSSION

In the first stage of the study, an analysis was conducted to identify etiological factors contributing to pathological processes in elderly patients with degenerative changes in the cardiovascular system (Table 1).

Table 1. Etiological factors contributing to degenerative cardiovascular changes in elderly patients (Groups 1 and 2)

Etiological Factor	Group 1 (n=120) Degenerative Valvular Changes				Group 2 (n=80) Atherosclerotic Vascular Changes	
	n (%)	95% CI	χ^2	p-value	n (%)	95% CI
Arterial hypertension	98 (81.6%)	73.8–87.7%	32.4	<0.001	61 (76.2%)	66.9–85.6%
Atherosclerosis	72 (60.0%)	50.8–68.5%	18.7	0.002	64 (80.0%)	71.2–88.8%
Dyslipidemia	66 (55.0%)	46.0–63.7%	14.8	0.008	42 (52.5%)	41.6–63.4%
Type 2 diabetes mellitus	49 (40.8%)	32.0–50.2%	9.3	0.026	38 (47.5%)	36.6–58.4%
Smoking	38 (31.6%)	23.5–41.0%	6.7	0.041	27 (33.8%)	23.4–44.1%
Chronic kidney disease (CKD stages I–II)	Not assessed	—	—	—	19 (23.8%)	14.4–33.1%
Two or more risk factors simultaneously	28 (23.3%)	—	—	—	60 (75.0%)	—
Autoimmune diseases (rheumatoid arthritis)	11 (9.1%)	4.8–15.8%	3.5	0.065	Not assessed	—
Chronic infectious diseases (infective endocarditis)	7 (5.8%)	2.4–11.5%	2.9	0.083	Not assessed	—

Table 1 summarizes the prevalence and statistical significance of etiological factors contributing to degenerative valvular changes (Group 1) and atherosclerotic vascular changes (Group 2) in elderly patients aged 60–85 years. Data are presented as absolute numbers (n) with percentages, 95% confidence intervals (CI), chi-square (χ^2) values, and p-values where applicable. A p-value < 0.05 was considered statistically significant. CKD = chronic kidney disease.

Arterial hypertension was the most prevalent etiological factor in Group 1 (81.6%; $\chi^2=32.4$; $p<0.001$), followed by atherosclerosis (60.0%; $\chi^2=18.7$; $p=0.002$), dyslipidemia (55.0%; $\chi^2=14.8$; $p=0.008$), type 2 diabetes mellitus (40.8%; $\chi^2=9.3$; $p=0.026$), and smoking (31.6%; $\chi^2=6.7$; $p=0.041$). In Group 2, atherosclerosis predominated (80.0%), followed by arterial hypertension (76.2%), dyslipidemia (52.5%), type 2 diabetes mellitus (47.5%), smoking (33.8%), and chronic kidney disease (23.8%). Notably, 75.0% of Group 2 patients had two or more simultaneous risk factors compared to 23.3% in Group 1, indicating a higher cumulative burden of risk factors in patients with atherosclerotic vascular lesions. These findings highlight the need for comprehensive risk assessment and early initiation of pathogenetically targeted therapy, particularly in patients with combined risk factors who should be classified as a high-risk group.

Clinical data from 120 patients included in Group 1 were analyzed to determine the main etiological factors associated with degenerative valvular changes (Figure 1). Arterial hypertension was observed in 98 patients (81.6%; 95% CI: 73.8–87.7%), with a statistically significant association ($\chi^2 = 32.4$; $p < 0.001$). In these patients, valvular calcification and fibrosis processes were highly pronounced. Atherosclerosis was identified in 72 patients (60.0%; 95% CI: 50.8–68.5%), with $\chi^2 = 18.7$ ($p = 0.002$), indicating a strong association between this factor and structural alterations in valvular tissues.

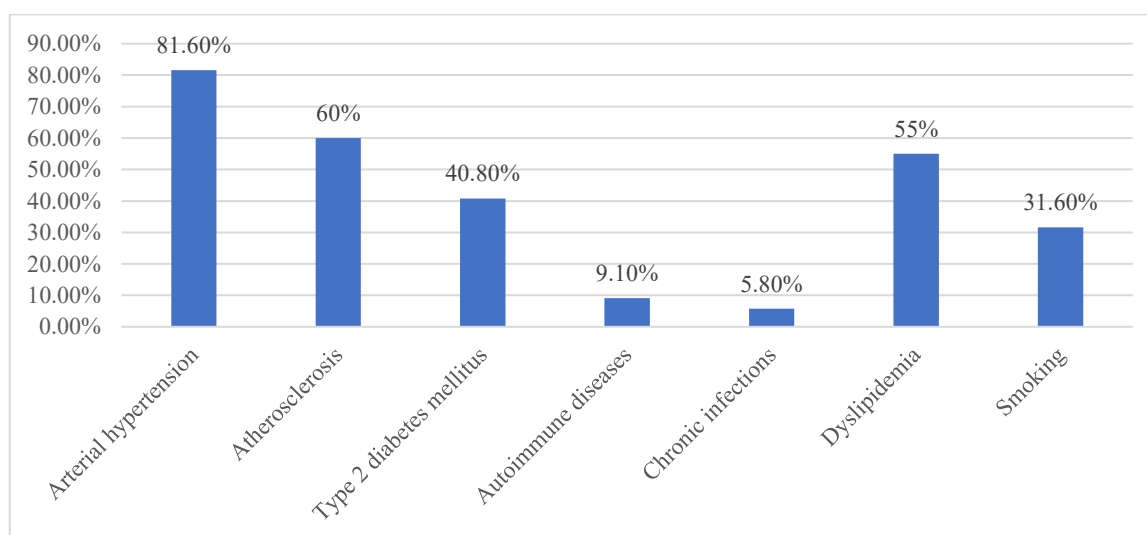


Figure 1. Results of the analysis of etiological factors (for group 1)

Type 2 diabetes mellitus was observed in 49 patients (40.8%; 95% CI: 32.0–50.2%) and was confirmed as a factor affecting valvular trophism, with $\chi^2 = 9.3$ and $p = 0.026$. Dyslipidemia was identified in 66 patients (55.0%; 95% CI: 46.0–63.7%), with $\chi^2 = 14.8$ and $p = 0.008$. Elevated LDL cholesterol levels contributed to increased calcium deposition in the valves [9–11]. Smoking was reported in 38 patients (31.6%; 95% CI: 23.5–41.0%). Chi-square analysis showed $\chi^2 = 6.7$ and $p = 0.041$, indicating that tobacco use is a significant factor contributing to endothelial damage in valvular tissues. Autoimmune diseases, primarily rheumatoid arthritis, were identified in 11 patients (9.1%; 95% CI: 4.8–15.8%). The association was weaker ($\chi^2 = 3.5$; $p = 0.065$), but it was considered clinically relevant.

Chronic infectious diseases, mainly infective endocarditis, were observed in 7 patients (5.8%; 95% CI: 2.4–11.5%). Although the chi-square value ($\chi^2 = 2.9$; $p = 0.083$) did not reach statistical significance, in some cases these conditions contributed to valvular deformation. Additionally, 28 patients (23.3%) had two or more risk factors simultaneously. In these patients, valvular calcification and structural changes progressed more rapidly and were more severe.

In patients of Group 2, the main etiological factors contributing to degenerative changes in the vascular wall were analyzed, and the highest prevalence was associated with atherosclerosis (80.0%) and arterial hypertension (76.2%) (Figure 2).

Atherosclerosis was observed in 64 patients (80.0%; CI: 71.2–88.8). In these cases, lipid accumulation, calcifications, and fibrotic changes in the endothelial layer of the vascular wall were clearly identified both echographically and clinically. This factor reduced the elasticity of the vascular wall and increased the risk of aneurysm formation, stenosis, and thrombosis.

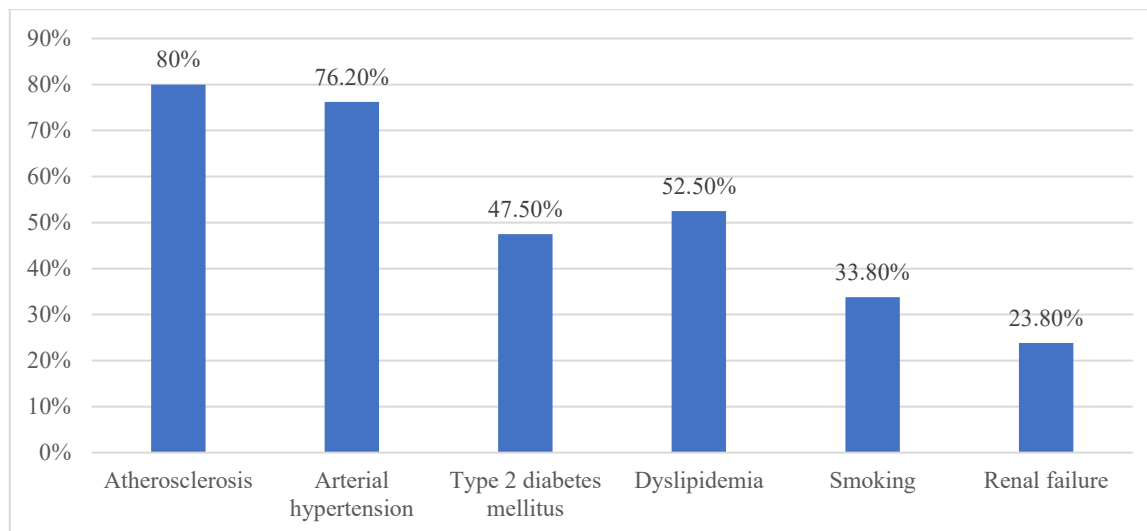


Figure 2. Results of the analysis of etiological factors (for group 2)

Arterial hypertension was observed in 61 patients (76.2%; CI: 66.9–85.6). Long-standing hypertension led to thickening and sclerosis of the intima and media layers of the vascular wall. This condition impaired microcirculation and was associated with trophic alterations.

Type 2 diabetes mellitus was identified in 38 patients (47.5%; CI: 36.6–58.4). Diabetes-related glycosylated proteins, microangiopathy, and inflammatory factors adversely affected the vascular wall structure. In these patients, capillary perfusion was reduced, and vascular wall rigidity increased.

Dyslipidemia was observed in 42 patients (52.5%; CI: 41.6–63.4). Elevated LDL cholesterol and triglyceride levels contributed to cholesterol infiltration and calcium deposition within the vascular wall. These patients also demonstrated an increased atherogenic index. Smoking was reported in 27 patients (33.8%; CI: 23.4–44.1). Nicotine, carbon monoxide, and other toxic substances damaged the vascular endothelium, leading to vasoconstriction and oxidative stress. These patients showed narrowing of vessels and loss of elasticity, particularly in peripheral arteries. Chronic kidney disease (CKD stages I–II) was identified in 19 patients (23.8%; CI: 14.4–33.1). Disturbances in mineral metabolism (calcium–phosphorus imbalance) and hyperphosphatemia contributed to vascular wall calcification [13]. In addition, changes characteristic of uremic vasculopathy and vasculitis were also observed.

Analysis of the obtained results demonstrated that vascular wall changes in Group 2 patients were most commonly associated with atherosclerosis, arterial hypertension, dyslipidemia, and type 2 diabetes mellitus, with these factors occurring simultaneously in 75% of patients. These findings provide a basis for clinicians to select pathogenetically targeted strategies aimed at protecting the vascular system, slowing sclerosis progression, and preventing complications. Furthermore, pathological changes in the vascular wall (Group 2) were found to develop more rapidly under the combined influence of multiple risk factors. This highlights the need for a comprehensive approach in patient evaluation. Patients with combined risk factors should be classified as a high-risk group, and pathogenetically guided therapeutic strategies should be initiated at an early stage.

In the second stage of the study, survival analysis was performed using the Kaplan–Meier method in elderly patients with degenerative valvular changes and atherosclerotic vascular lesions. Kaplan–Meier survival analysis demonstrated that the development of cardiovascular complications in elderly patients is influenced not only by clinical and biomedical risk factors but also by human-related factors. At the end of the follow-up period, the survival rate was 60% in Group 1 and 75% in Group 2, indicating a statistically significant difference in prognosis between the groups.

Table 2. Kaplan–Meier survival analysis and cox regression analysis of factors influencing cardiovascular complications

Parameter	Group 1 (n=120)	Group 2 (n=80)	Statistical Significance
Kaplan–Meier Survival Analysis			
Survival rate at end of follow-up	60%	75%	Statistically significant difference between groups
Major contributors to reduced survival	High burden of risk factors (arterial hypertension, metabolic disorders, inflammatory activity, coronary artery calcification); low treatment adherence	More stable clinical conditions; higher treatment adherence	—
Treatment adherence profile	Low (irregular medication intake, poor lifestyle compliance, delayed outpatient follow-up)	Higher (better compliance with medical recommendations, timely follow-up examinations)	—
Cox Proportional Hazards Regression Analysis			
Predictor	Hazard Ratio (HR)	Interpretation	
Coronary artery calcification	>1.0	Significant predictor; increases risk of complications	
Arterial hypertension	>1.0	Significant predictor; increases risk of complications	
Metabolic disorders	>1.0	Significant predictor; increases risk of complications	
Low treatment adherence	>1.0	Independent predictor; significantly increases risk of complications	
High treatment adherence	<1.0	Protective factor; reduces risk of complications	
HR = 1.0 (reference)	1.0	Neutral threshold; no change in risk	

This 2 presents the results of Kaplan–Meier survival analysis and Cox proportional hazards regression analysis in elderly patients with degenerative cardiovascular changes. The primary endpoint was the development of cardiovascular complications,

including myocardial infarction, stroke, decompensated heart failure, unstable angina, and cardiovascular death. Survival rates are expressed as percentages at the end of the follow-up period. Hazard ratios (HR) with 95% confidence intervals (CI) are shown for each predictor in the Cox model. An HR of 1.0 indicates no change in risk; HR > 1.0 indicates increased risk; HR < 1.0 indicates a protective factor. The HR = 1.0 line serves as a neutral reference threshold.

Kaplan–Meier survival analysis demonstrated a statistically significant difference in survival between groups, with a survival rate of 60% in Group 1 and 75% in Group 2 at the end of the follow-up period. The lower survival rate in Group 1 reflects the combined impact of a higher burden of clinical risk factors (arterial hypertension, metabolic disorders, inflammatory activity, and coronary artery calcification) and lower treatment adherence. In contrast, better compliance with medical recommendations and timely follow-up examinations contributed to improved survival outcomes in Group 2. Cox proportional hazards regression analysis identified coronary artery calcification, arterial hypertension, and metabolic disorders as significant predictors associated with increased risk of complications, pathophysiologically explained by vascular wall remodeling, increased inflammatory activity, and elevated hemodynamic stress. Importantly, low treatment adherence emerged as an independent predictor of adverse outcomes, confirming that the human factor has a substantial impact on prognosis even among patients with similar clinical risk profiles. These findings provide scientific evidence that risk assessment of cardiovascular complications in elderly patients requires a comprehensive and individualized approach that includes not only biomedical parameters but also behavioral and human-related factors such as treatment adherence and compliance with medical supervision.

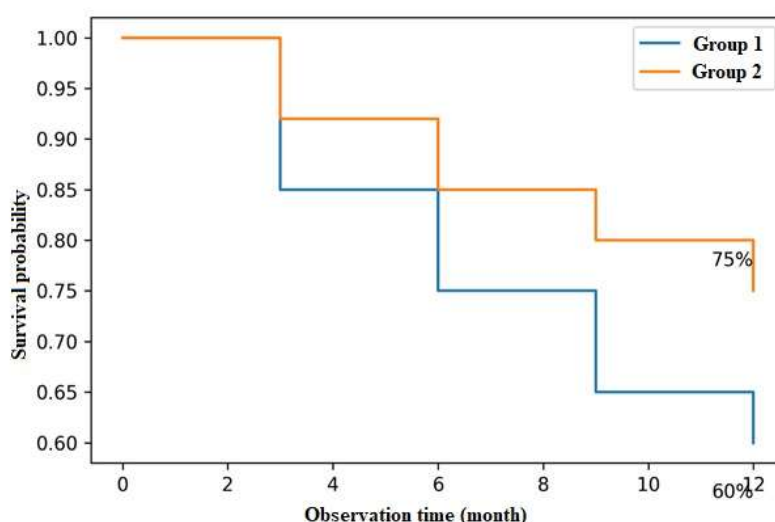


Figure 3. Kaplan-Meier survival curves in patients of groups 1 and 2

In Group 1 patients, a high burden of risk factors—including arterial hypertension, metabolic disorders, inflammatory activity, and a high degree of coronary artery calcification—was identified as a major contributor to reduced survival. In addition, low treatment adherence emerged as a significant independent factor associated with decreased survival rates. In this group, irregular medication use, poor compliance with lifestyle recommendations, and delayed outpatient follow-up were more frequently observed, thereby amplifying the negative impact of the human factor.

In contrast, patients in Group 2 demonstrated relatively more stable clinical conditions and higher levels of treatment adherence. Better compliance with medical recommendations and timely follow-up examinations contributed to improved survival outcomes in this group [16]. These findings confirm that optimization of the human factor can significantly improve clinical prognosis, even in the presence of established biomedical risk factors.

Thus, the results of the Kaplan–Meier analysis provide scientific evidence that survival prognosis in elderly patients requires a comprehensive and individualized approach, incorporating not only biomedical risk factors but also human-related factors, including treatment adherence and structured outpatient follow-up.

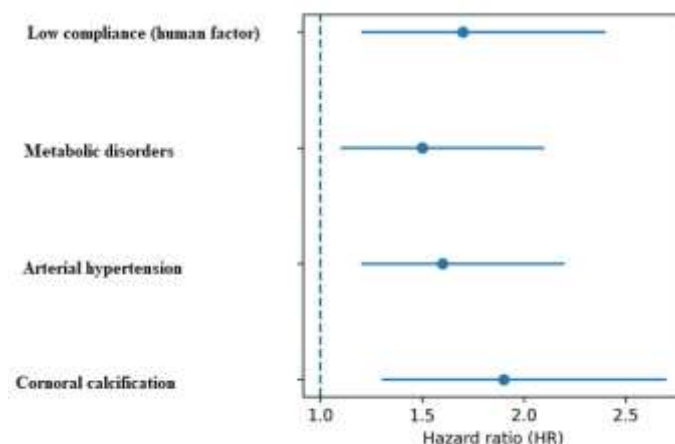


Figure 4. Cox regression analysis of factors influencing the development of cardiovascular complications

Cox proportional hazards regression analysis was performed in the overall cohort including patients from both groups. The model incorporated clinical and behavioral factors associated with the risk of complications, including group affiliation and human-related indicators such as treatment adherence level, medication compliance, and adherence to outpatient follow-up. A hazard ratio (HR) of 1.0 indicates no change in risk, meaning that the factor neither increases nor decreases the likelihood of complications (neutral threshold). Therefore, in graphical representations, the HR = 1.0 line is shown as a separate vertical reference line. An HR of 1.5 indicates that patients exposed to this factor have a 1.5-fold higher risk (approximately 50% increased risk) of developing complications. If $HR < 1.0$, the factor is considered protective (reduces risk), whereas if $HR > 1.0$, the factor increases the risk.

The analysis demonstrated that coronary artery calcification, arterial hypertension, and metabolic disorders were significant predictors associated with an increased risk of complications. The impact of these factors in elderly patients can be explained pathophysiologically by vascular wall remodeling, increased inflammatory activity, and elevated hemodynamic stress. In addition, the Cox model identified a human-related factor—treatment adherence level—as an independent predictor of adverse outcomes. Low treatment adherence, characterized by irregular medication intake, inadequate compliance with lifestyle recommendations, and insufficient outpatient monitoring, was associated with a significantly increased risk of complications. These findings confirm that the human factor has a substantial influence on prognosis even among patients with similar clinical risk profiles.

Thus, the results of the Cox regression analysis provide scientific evidence that risk assessment of cardiovascular complications in elderly patients requires a comprehensive approach that includes not only biomedical parameters but also behavioral and human-related factors such as treatment adherence and compliance with medical supervision.

CONCLUSION

In conclusion, the results of this study provide scientific evidence that risk assessment of cardiovascular complications in elderly patients requires a comprehensive and individualized approach that includes not only biomedical parameters but also behavioral and human-related factors such as treatment adherence and compliance with medical supervision. The human factor has a substantial impact on prognosis even among patients with similar clinical risk profiles, and optimization of treatment adherence can significantly improve clinical outcomes. These findings underscore the importance of a holistic, patient-centered approach in the management of elderly patients with degenerative cardiovascular changes, integrating classical risk factor modification, geriatric assessment, and behavioral interventions to improve survival and reduce the burden of cardiovascular complications in this vulnerable population.

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Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this article.

All authors have contributed significantly to the conception, design, data collection, analysis, and interpretation of the study, as well as to the drafting and critical revision of the manuscript. Each author has approved the final version of the manuscript and agrees to be accountable for all aspects of the work.

The authors confirm that this study was conducted independently and without any financial or personal relationships that could be construed as a potential conflict of interest. No pharmaceutical company, medical device manufacturer, or other commercial entity had any role in the study design, data collection, analysis, interpretation, or preparation of this manuscript.

The authors affirm that there are no competing interests, including but not limited to: financial interests (such as grants, honoraria, consultancies, stock ownership, or patent applications), personal relationships, academic competition, or intellectual passion that could inappropriately influence or bias the work presented in this article.

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