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# Effect of senile asthenia syndrome on cardiovascular mortality within 12 months in patients over 70 years of age with myocardial infarction

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**Aim.** This study aims to investigate the effect of senile asthenia syndrome (SAS) on the cardiovascular mortality risk within 12 months in patients over 70 years of age with myocardial infarction.

**Material and methods.** We performed a retrospective study of 92 patients over 70 years of age with myocardial infarction, who agreed to participate. To detect senile asthenia syndrome, we used the questionnaire "Age is not a hindrance". We estimated the anamnestic data, and also laboratory and instrumental parameters. The follow-up period was 12 months. As an end-point, the onset of an adverse event — cardiovascular death was chosen. Statistical non-parametric methods, ROC analysis, Kaplan-Meier survival analysis (p<0,05) were used.

**Results.** In 12 months, 19 patients (20,65%) met the end-point. The median (25%; 75%-quartile) of the numbers of points according to the questionnaire "Age is not a hindrance" was significantly higher in the group of dead patients than in the group without adverse outcomes — 4 (3; 5) and 2 (1; 4) points (p<0,001). When gaining 3 or more points according to the questionnaire "Age is not a hindrance", risk ratio of cardiovascular death within 12 months was 1,72; 95% confidence interval: 1,28-2,30 (p=0,001). In conduction of ROC analysis to predict adverse outcome when gaining 3 or more points according to the questionnaire "Age is not a hindrance", the area under the curve (AUC) was 0,78 (p<0,001), sensitivity — 89%, specificity — 60%.

**Conclusion.** The risk of cardiovascular death within 12 months after myocardial infarction in patients over 70 years of age with SAS increases by 72%. The inclusion of the results from the questionnaire "Age is not a hindrance" into prognostic models, and the SAS estimation in this cohort of patients will improve the risk stratification.

**Keywords:** myocardial infarction, senile asthenia syndrome, frailty syndrome, medium-term forecast, cardiovascular death.

**Relationships and Activities:** none.

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In recent decades demographic changes in the world are characterized by an increase in the number of elderly and senile people. And one of relevant problems related to human aging is a senile asthenia syndrome (SAS) [1]. SAS is a geriatric syndrome which is characterized by the formation of age-associated decrease in the physiological reserve and functions of many of body systems, that leads to increased vulnerability of elderly people to the effects of endogenous and exogenous factors and to a high risk of adverse health outcomes, loss of autonomy and death. There are two approaches to the etiology of SAS development. The first approach, according to Fried LP, et al., consider senile asthenia as genetically-caused phenotype, while the second approach, according to Rockwood K, et al. — as the collection of accumulated deficiency of functions against the background of polymorbid pathology [2, 3].

**Table 1**

**Clinical and anamnestic characteristics of the groups of the patients depending on the number of the points obtained from the questionnaire "Age is not a hindrance"**

| Parameter | Group I, N=46 (50%) | Group II, N =46 (50%) | $\chi^2$ | p |
|---|---|---|---|---|
| Age, years, Me (Q25; Q75) | 81,50 (77,00; 84,25) | 72,00 (70,00; 77,25) | | <0,001 |
| BMI, kg/m$^2$, Me (Q25; Q75) | 28,54 (24,38; 30,23) | 28,35 (25,23; 30,25) | | 0,781 |
| In anamnesis: | | | | |
| Past myocardial infarction, n (%) | 22 (48) | 13 (28) | 2,95 | 0,086 |
| ACVA, n (%) | 10 (22) | 3 (7) | 3,22 | 0,073 |
| Atrial fibrillation, n (%) | 17 (37) | 8 (17) | 3,52 | 0,061 |
| Arterial hypertension, n (%) | 46 (100) | 45 (98) | 0,001 | 1,000 |
| CHF IIA and more severe, n (%) | 45 (98) | 33 (72) | 10,19 | 0,001 |
| Diabetes mellitus, type 2<br>— insulin-dependent, n (%) | 15 (33)<br>4 (9) | 11 (24)<br>2 (4) | 1,88 | 0,390 |
| Peripheral arterial atherosclerosis, n (%) | 5 (11) | 6 (13) | 0,001 | 1,000 |
| PCI, n (%) | 3 (7) | 3 (7) | 0,001 | 1,000 |
| PSI (stent implantation) during current hospitalization | 16 (38) | 33 (72) | 8,75 | 0,003 |
| ACS, n (%) | 0 | 0 | – | – |
| Chronic kidney disease, n (%):<br>C1<br>C2<br>C3a<br>C3б | <br>0<br>23 (50)<br>12 (26)<br>11 (24) | <br>2 (4)<br>25 (54)<br>16 (36)<br>3 (6) | 10,03 | 0,040 |
| At admission: | | | | |
| Class of AHF according to Killip, n (%):<br>Killip I<br>Killip II<br>Killip III<br>Killip IV | <br>29 (63)<br>5 (11)<br>7 (15)<br>5 (11) | <br>37 (81)<br>5 (11)<br>2 (4)<br>2 (4) | 5,03 | 0,169 |
| ST elevation on ECG, n (%) | 9 (20) | 21 (46) | 5,98 | 0,014 |

**Abbreviations:** ACS — aortocoronary shunting, BMI — body mass index, ACVA — acute cerebrovascular accident, AHF — acute heart failure, CHF — chronic heart failure, PCI — percutaneous coronary intervention, ECG — electrocardiogram.

The diagnostics of SAS is conducted during a comprehensive geriatric assessment, however, the presence of an acute disease, including myocardial infarction (MI), is a contraindication for the comprehensive geriatric assessment [4-6]. In this case SAS is detected by the use of screening questionnaires. The following instruments for SAS diagnostics are used more frequently: Fried Scale based on Cardiovascular Health Study, Frailty Index based on Canadian Study of Health and Aging, Rockwood Clinical Frailty Scale, Edmonton Frail Scale (EFS) and five-component FRAIL scale [7-10]. The most relevant screening questionnaire in our country is "Age is not a hindrance" — domestic analogue of the FRAIL scale [6]. When scoring 0-2 points on the scale "Age is not a hindrance", the absence of SAS in a patient is determined, 3-4 points — pre-asthenia is diagnosed, ⩾5 points — SAS [4, 5]. The prevalence of SAS among individuals older than 65 years is ~10,7%, increasing up to 52% among individuals older than 85 years [11].

The presence of SAS is an unfavorable factor that increases the risk of adverse outcomes. The recent studies indicate an independent prognostic value of SAS in elderly and senile patients with MI [12, 13]. For example, the study of patients older than 70 years having acute coronary syndrome with ST-segment elevation, who underwent primary percutaneous coronary intervention (PCI) in Leiden university, assessed the prognosis of patients depending on the presence of SAS (30-day mortality, major bleeding, renal failure *de novo* (contrastinduced), clinical death within 30 days, acute cerebrovascular accident (ACVA)). Fragile patients were determined using the test consisting of 12 questions Safety Management Program (SMP) when scoring >1 points. The frequency of occurrence of endpoints was reliably higher that in the group of the patients with ⩾1 points [14].

It should be noted that geriatric state of elderly and senile patients with MI is more often not evaluated that makes it difficult to stratify the risk of this

**Table 2**

**Distribution of points according to the scales of assessment of the risk of an adverse event, including bleedings, across the groups of the patients depending on the number of points obtained from the questionnaire "Age is not a hindrance"**

| Scales | Group I (n=46), Me (Q1; Q3) | Group II (n=46), Me (Q1; Q3) | p |
|---|---|---|---|
| CRUSADE scale, points | 43,00 (35,75; 54,50) | 35,50 (25,75; 46,75) | 0,012 |
| GRACE scale, points | 174,00 (154,75; 195,75) | 153,00 (142,75; 166,25) | <0,001 |
| PRECISE-DAPT scale, points | 26,00 (19,75; 33,75) | 19,00 (15,00; 24,00) | 0,002 |
| TIMI scale, points | 6,00 (4,00; 8,00) | 4,00 (3,00; 5,00) | 0,001 |

**Table 3**

**Comparative analysis of EchoCG data between the groups of the patients depending on the number of points obtained from the questionnaire "Age is not a hindrance"**

| Parameter | Group I (n=46), Me (Q1; Q3) | Group II (n=46), Me (Q1; Q3) | p |
|---|---|---|---|
| EF according to Simpson, % | 45,50 (38,00; 54,25) | 52,00 (48,00; 56,25) | 0,021 |
| LV ESV, ml | 50,50 (39,75; 75,25) | 55,00 (45,00; 73,25) | 0,529 |
| LV EDV, ml | 105,50 (81,25; 126,25) | 119,50 (99,25; 139,50) | 0,028 |
| LV EDV/$m^2$, ml/$m^2$ | 61,00 (47,50; 70,50) | 61,00 (53,00; 73,00) | 0,385 |
| LVRWT, proportions of the whole | 0,44 (0,37; 0,51) | 0,43 (0,39; 0,47) | 0,264 |
| LAVI, ml/$m^2$ | 40,50 (34,00; 47,00) | 35,00 (27,75; 41,25) | 0,013 |
| ILCD | 1,60 (1,38; 1,93) | 1,40 (1,20; 1,60) | 0,036 |
| IVCD, mm | 19,00 (18,00; 20,25) | 19,00 (18,00; 20,25) | 0,625 |
| SPAP, mm Hg | 38,40 (33,93; 47,85) | 34,20 (28,75; 41,50) | 0,023 |
| E/A | 0,70 (0,60; 0,78) | 0,70 (0,60; 0,90) | 0,734 |
| E/e’ | 7,35 (6,00; 12,00) | 9,00 (6,50; 11,00) | 0,864 |
| LVMI, g/$m^2$ | 109,00 (85,00; 137,25) | 106,50 (91,25; 121,00) | 0,663 |
| Mitral valve insufficiency | | | |
| Degree | I группа, N (%) | II группа, N (%) | $\chi^2$ (p=0,032) |
| No | 3 (7) | 11 (24) | 8,84 |
| Degree 1 | 31 (67) | 31 (67) | |
| Degree 2 | 11 (24) | 4 (9) | |
| Degree 3 | 1 (2) | 0 (0) | |

**Abbreviations:** IVCD — inferior vena cava diameter, LVMI — left ventricular mass index, ILCD — index of local contractility disorders, LAVI — left atrial volume index, EDV — end-diastolic volume, EDV/$m^2$ — end-diastolic volume standardized relatively to body surface area, ESV — end-systolic volume, LV — left ventricle, LVRWT — left ventricular relative wall thickness, SPAP — systolic pulmonary artery pressure, EF — ejection fraction, E/A — ratio of early peak velocity of transmitral blood flow to late peak velocity, E/e’ — ratio of late peak velocity of transmitral blood flow to velocity of early diastolic mitral annular motion.

group of patients. And the risk of adverse outcomes in elderly and senile patients is more often associated not with age but with the presence of senile asthenia. Thus, in practice, "frailty" is not only a geriatric syndrome which needs to be diagnosed and treated by itself but a potential component of risk models too. The assessment of the likelihood of the presence and severity of SAS can become an independent marker of high risk of adverse outcomes in elderly and senile patients [15].

The study aims to investigate the influence of SAS on the risk of cardiovascular death (SVD) during 12 months in patients older than 70 years with MI.

## Material and methods

Our prospective study included 92 patients with ST-elevation MI and non-ST-elevation MI older than 70 years, who were treated in cardiology departments of the Samara State Medical University Clinics in the period from 2020 to 2021 and gave informed consent to participate in the study. The conduction of the study was approved by Ethics Committee of Samara State Medical University of

**Table 4**

**Comparative analysis of results of assessment of individual geriatric symptoms between the groups of the patients depending on the number of points obtained from the questionnaire "Age is not a hindrance"**

| Parameter | Group I (n=46), Me (Q1; Q3) | Group II (n=46), Me (Q1; Q3) | p |
|---|---|---|---|
| Questionnaire "Age is not a hindrance", points | 4,00 (3,00; 5,00) | 1,00 (0,00; 2,00) | <0,001 |
| Charlson comorbidity index, points | 6,50 (5,00; 7,00) | 5,00 (4,00; 6,00) | <0,001 |
| Time spent on the "Get up and go" test, sec | 15,00 (13,75; 18,00) | 9,50 (9,00; 10,25) | <0,001 |
| Mini Nutritional Assessment, points | 19,00 (18,00; 20,78) | 21,00 (20,00; 22,50) | <0,001 |
| Philadelphia Geriatric Morale Scale, points | 52,50 (43,75; 60,00) | 44,00 (36,00; 55,25) | 0,029 |
| Mini-Mental State Examination, points | 20,00 (18,00; 23,00) | 22,00 (20,75; 24,00) | 0,001 |
| Barthel Activities of Daily Living Index, points | 80,00 (70,00; 90,00) | 95,00 (95,00; 95,00) | <0,001 |

the Ministry of Health of the Russian Federation from 30.09.2020. The exclusion criteria: the presence of endocrine pathology (except for diabetes mellitus (DM) type 2); oncological diseases with life expectancy <1 years; anamnestic data on the hereditary pathology of the hemostasis system, severe cognitive disorder according to the scale Mini-Mental State Examination (a brief scale for assessing mental state), severe liver failure (the presence of liver cirrhosis, increased activity of alanine aminotransferase and aspartate aminotransferase by more than 5 times), severe renal failure (glomerular filtration rate (GFR) <30 ml/min/1,73 $m^2$ by CKD-EPI formula), the presence of acute kidney injury and acute kidney disease in current hospitalization. We estimated the data of clinical picture and anamnesis, the results of general clinical and laboratory tests, structural and functional parameters of heart (transthoracic echocardiography (EchoCG) using Philips Affiniti 50 (Netherlands) machine). The patients examined and treated in accordance with the clinical recommendations for the management of patients with acute ST-elevation and non-ST-elevation MI [16, 17]. The patients included into the study had acute disease that is why on this stage we used the screening questionnaire "Age is not a hindrance" [4, 5] that allowed us to make a preliminary conclusion about possible presence of SAS. We also determined the Charlson Comorbidity Index. Based on the result obtained from the questionnaire "Age is not a hindrance", the patients were divided into 2 groups: group I (n=46) — with the number of points ⩾3 ("fragile" and "pre-fragile" patients), group II (n=46) — 0-2 points (the patients without SAS). At admission we assessed the risk of adverse outcomes during hospital stay in the patients with acute coronary syndrome without ST-elevation on ECG according to the GRACE scale, and in the patients with ST-elevation on ECG — according to the TIMI scale. We assessed the risk of bleedings during hospital stay in the patients with acute coronary syndrome according to the CRUSADE scale and the risk of bleedings in the patients after PCI at the use of double antiplatelet therapy (the PRECISE-DAPT scale). The detection and determination of severity of geriatric syndromes including SAS were conducted by a cardiologist using the special scales on $5^{th}$ day of hospitalization after the stabilization of patients` condition. The motor activity was assessed using the "Get up and go" test with fixation of time; functional activity — according to the scale of the assessment of basic functional activity of Barthel (Barthel Activities of daily living Index); nutritional state — Mini Nutritional Assessment scale (a brief scale of nutritional assessment); moral state — Philadelphia geriatric morale scale; mental state — Mini-Mental State Examination. When performing the "Get up and go" test, the patient was asked to sit on a stable chair, leaning on the back. The patient had to get up from the chair, walk 3 meters, turn around, walk back to the chair and sit on it, leaning on the back. The time spent by the patient on the test was recorded [3, 4]. 12 months after hospitalization, we determined the endpoint achievement by contacting patients` relatives. We accepted CVD to be the endpoint (fatal recurrent MI, ACVA, decompensation of chronic heart failure (CHF)). Then the patients were divided into 2 groups: group A — the patients without the adverse outcome and group B — the patients with the adverse outcome. Statistical nonparametric methods, ROC analysis, Kaplan-Meier survival analysis were used. Quantitative signs are represented in the form of a median (25%; 75% quartile), differences between groups were evaluated by the Mann-Whitney U test. Qualitative signs are represented in the form of an absolute quantity and a percentage of the whole. Comparison of qualitative signs was carried out according to Pearson's $\chi^2$ criterion. P<0,05 is taken as the level of statistical reliability. The Statistica 8.0 program was used for statistical analysis.

**Table 5**

**Differences between the patients depending on an outcome according to clinical laboratory parameters**

| Parameter | Group A Without adverse outcome, Me (Q1; Q3), n=73 | Group B CVD, Me (Q1; Q3), n=19 | p |
|---|---|---|---|
| Age, years | 76,00 (71,00; 81,50) | 82,00 (74,00; 85,00) | 0,010 |
| Duration of hospitalization, days | 10,00 (8,00; 11,50) | 11,50 (8,75; 13,75) | 0,170 |
| Questionnaire "Age is not a hindrance", points | 2,00 (1,00; 4,00) | 4,00 (3,00; 5,00) | <0,001 |
| Charlson comorbidity index, points | 5,00 (5,00; 6,00) | 7,00 (7,00; 8,00) | <0,001 |
| Time spent on the "Get up and go" test, sec | 11,00 (9,00; 15,00) | 14,00 (12,00; 18,00) | 0,008 |
| Nutritional state, points | 20,70 (19,00; 22,00) | 19,00 (18,00; 20,00) | 0,024 |
| Barthel functional activity, points | 95,00 (85,00; 95,00) | 80,00 (65,00; 95,00) | 0,002 |
| Redd blood cell count, $\times 10^{12}$/l | 4,56 (4,18; 4,83) | 3,95 (3,52; 4,26) | <0,001 |
| Hemoglobin, g/l | 136,00 (125,50; 146,00) | 120,00 (108,00; 129,00) | 0,001 |
| Glucose, mmol/l | 6,15 (5,13; 7,90) | 8,96 (6,32; 12,91) | 0,002 |
| Urea, mmol/l | 6,30 (4,98; 8,13) | 9,90 (8,10; 14,40) | 0,001 |
| Creatinine, μmol/l | 83,00 (71,00; 101,60) | 115,30 (74,60; 135,20) | 0,006 |
| GFR according to CKD-EPI, ml/min/1,73 $m^2$ | 65,00 (52,00; 78,50) | 45,00 (39,00; 62,00) | 0,001 |

**Abbreviations:** GFR — glomerular filtration rate, CVD — cardiovascular death.

**Table 6**

**Differences between the patients depending on an outcome according to clinical laboratory parameters (continuation)**

| Parameter | Group A Without adverse outcome, n=73 (79,35%) | Group B CVD, n=19 (20,65%) | p |
|---|---|---|---|
| Past MI in anamnesis | 21 (29) | 14 (74) | 0,001 |
| Diabetes mellitus | 16 (22) | 10 (53) | 0,014 |
| The class of acute left ventricular failure at admission: | | | 0,015 |
| Killip I | 57 (78) | 9 (47) | |
| Killip II | 5 (7) | 5 (26) | |
| Killip III | 5 (7) | 4 (21) | |
| Killip IV | 6 (8) | 1 (5) | |
| ST elevation | 28 (32) | 2 (11) | 0,042 |
| BLLBH | 4 (6) | 8 (42) | 0,001 |
| Atrial fibrillation/flutter | 13 (18) | 10 (53) | 0,005 |
| PCI during current hospitalization | 44 (62) | 5 (29) | 0,031 |

**Abbreviations:** BLLBH — blockage of left leg of the bundle of His, MI — myocardial infarction, CVD — cardiovascular death, PCI — percutaneous coronary intervention.

## Results

The mean age of the patients in the investigated cohort was 77,3±2,4 years. Of them men — 47,8% (n=44). The patients were divided into 2 groups according to the number of scored points obtained from the questionnaire "Age is not a hindrance". The group I included the patients with probable SAS and pre-asthenia (⩾3 points), n=46 (50%); the group II included the "non-fragile" patients (0-2 points), n=46 (50%). The clinical and anamnestic characteristics of the patients according to the groups are shown in Table 1. The patients in the group I with probable SAS and pre-asthenia were reliably older, had lower GFR at admission, and more frequently had stagnant CHF in anamnesis. While the patients from the group II reliably more frequently had ST-elevation MI. Reliable differences in the level of red blood cell, hemoglobin, potassium and sodium were observed. The patients with SAS and pre-asthenia had lower level of hemoglobin and red blood cells

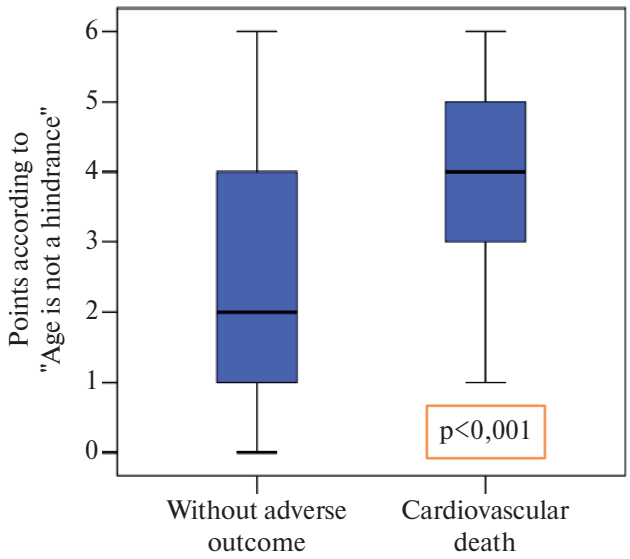


**Figure 1.** Distribution of points according to the questionnaire "Age is not a hindrance" depending on an outcome of the patients.

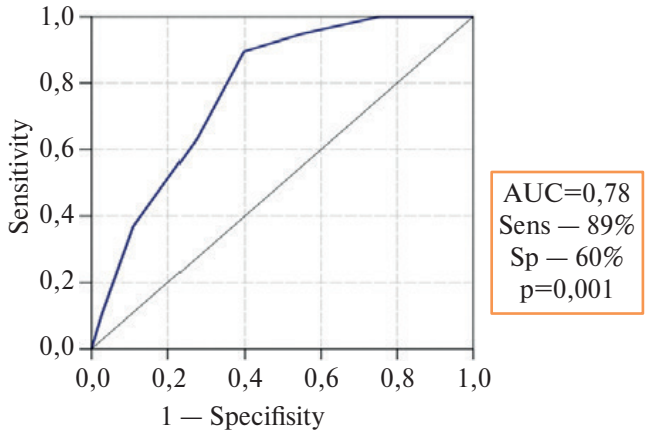


**Figure 2.** ROC-curve of CVD forecasting during 12 months after MI in patients older than 70 years when scoring ⩾3 points according to the questionnaire "Age is not a hindrance".

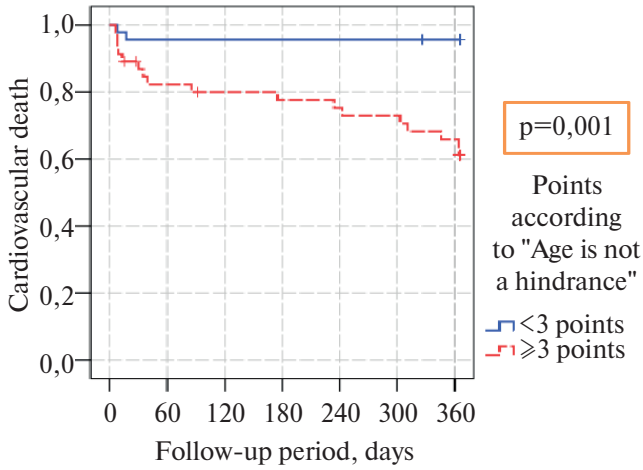


**Figure 3.** Analysis of survival of the patients depending on the number of points obtained from the scale "Age is not a hindrance".

compared to the group II. Thus, the medians (25%; 75% quartiles) of the level of red blood cells were in the groups 4,21 (3,84; 4,68) $\times 10^{12}$/l and 4,58 (4,24; 4,84) $\times 10^{12}$/l, respectively, p=0,004, and of the level of hemoglobin — 125,00 (109,75; 138,25) g/l and 137,00 (129,50; 147,00) g/l, p=0,001. Along with this, a quarter of the patients from the group I had mild anemia. There were no reliable differences in the level of hf-troponin T, the lipid profile components, creatinine and other laboratory parameters. The medians (25%; 75% quartiles) of GFR by CKD-EPI at admission in the groups were 61,00 (42,50; 70,25) ml/min/1,73 $m^2$ and 65,00 (52,00; 78,25) ml/min/1,73 $m^2$, respectively (p=0,102).

The patients of the group I both with and without ST-elevation had a reliably higher risk of in-hospital adverse cardiovascular events. The risk of bleedings during hospital stay as well as in taking double antiaggregating therapy was also reliably higher than in the group of the patients with SAS and pre-asthenia compared to the "non-fragile" patients. The distribution of the number of points according to the scales of the assessment of the risk of adverse outcomes and bleedings depending on the presence of SAS is shown in Table 2.

The patients included into the study received a standard medication therapy in accordance with relevant clinical guidelines including double antiaggregating therapy. However, in the group I clopidogrel was preferred in 70% of cases, and loop diuretics were also reliably more often prescribed for this group.

Structural and functional condition of myocardium was evaluated using transthoracic EchoCG in all patients during 24 hours from the moment of admission to the hospital. Comparative analysis of EchoCG data is shown in Table 3. Reliable differences in the values of left ventricular (LV) end-diastolic volume (p=0,028) and ejection fraction (p=0,021) between the groups were observed. Thus, in the patients of the group II preserved and moderately decreased EF was detected more frequently (the median of EF was 52%), whereas in the patients of the group I — moderately decreased and decreased EF (the median — 45,5%).

The group I compared to the group II had reliably higher left atrial volume index (the medians were 45,5 ml/$m^2$ and 35,0 ml/$m^2$, respectively, p=0,013) and pulmonary artery pressure (the medians were 38,4 and 38,2 mm Hg, respectively, p=0,023).

There were no significant differences in severity of diastolic dysfunction, left ventricular mass index, left ventricular relative wall thickness as well as in inferior vena cava diameter. The patients in the

group I had reliably higher degree of mitral regurgitation (p=0,032).

During the first 24 hours from the moment of hospitalization all patients underwent coronary angiography with probable PCI in roentgen operating room (using the angiography machine General Electric Innova 3100IQ). And this showed no reliable differences between the groups of the patients in the number of injured vessels. However, the frequency of performing PCI was reliably higher in the group I — 72% vs 38% in the group II, p=0,003. The most often reasons of the refusal from PCI in both groups were the presence of three-vascular diffuse lesion as well as the technical impossibility to perform PCI. The estimation of the PCI complications revealed no reliable differences between the groups of the patients.

Comparative analysis of geriatric syndromes is shown in Table 4. In the group I compared to the group II, reliable difference in severity of all geriatric syndromes and the level of comorbidity index was observed. The patients of the group I had reduced motor activity in a moderate degree. Mild dementia was revealed in both groups but it was expressed in a greater extent in "fragile" and "pre-fragile" patients (p=0,001). Also, these patients were reliably more dependent on outside care (moderate extent of dependence according to Barthel index). The patients in the group I had satisfactory moral state with the risk of developing depression, and in the group II — good moral state without the risk of developing depression; the differences in moral state were reliable. As for nutritional state, both groups were in the risk zone of nutritional deficiency, and these disorders were reliably more expressed in the group I.

12 months later, by a method of phone contact with patients` relatives, it was ascertained that 19 patients achieved the endpoint. Then, depending on the presence of the adverse outcome, the following groups were made: group A included 73 patients (79,35%) without the adverse outcome, group B — 19 with the adverse outcome (20,65%). The individuals with the adverse outcome included 18 patients from the group I.

When comparing the clinical and laboratory parameters depending on an outcome (Tables 5 and 6), the following reliable differences were obtained. The patients from the group with the adverse outcome were older and more often had past MI, DM and atrial fibrillation (AF) in anamnesis. In this group, ST-segment elevation was found less frequently, and blockage of left leg of the bundle of His was recorded more frequently at admission as well as the class of heart failure was higher. The laboratory indices showed reliable differences in the level of hemoglobin, red blood cells and GFR. Also, the individuals in the group with the adverse outcome had higher Charlson comorbidity index and more pronounced geriatric syndromes.

Distribution of points according to the questionnaire "Age is not a hindrance" depending on the outcomes is shown in Figure 1. Thus, the medians (25%; 75% quartiles) in the groups were, 2 (1-4) and 4 (3; 5), respectively, at p<0,001.

The data of ROC analysis performed to forecast CVD during 12 months after MI in the patients older than 70 years showed an unfavorable result obtained from the questionnaire "Age is not a hindrance", equal to 3 points. The area under curve (AUC) was 0,78, at sensitivity of 89% and specificity of 60% (p=0,001). The risk ratio (95% confidence interval) when scoring ⩾3 points by the questionnaire "Age is not a hindrance" for the adverse outcome onset for the investigated category of patients was 1,72 (1,28-2,30) at p=0,001. When constructing survival Kaplan-Meier curves for the patients in the general cohort, the forecast of CVD during 12 months was higher in the patients who scored ⩾3 points by the questionnaire "Age is not a hindrance" (p=0,001) (Figure 2). The Figure 3, which presents the survival curves, shows that this population of the patients reduces by 40% by 1 year after MI.

## Discussion

The data we obtained on the prevalence of probable SAS in the investigated population do not contradict the literature data — 17,4%. We revealed a reliably higher level of comorbidity and risk of adverse outcomes as well as bleedings in this category of individuals that coincides with the data obtained by other researchers [11]. The patients with adverse outcome reliably more frequently had past MI in anamnesis (p=0,001) and DM (p=0,014); at admission, ST-segment elevation was recorded more frequently (p=0,042) or blockage of left leg of the bundle of His (p=0,001), atrial fibrillation or flutter (p=0,005). In the group with the adverse outcome compared to survival patients, the median (25%; 75% quartiles) of EF according to Simpson was 37,00% (34,00; 44,00) and 52,00% (47,00; 56,00), left ventricular volume index — 42,00 (35,00; 53,00) ml/m$^2$ and 36,00 (30,00; 42,50) ml/m$^2$; systolic pulmonary artery pressure — 45,70 (38,60; 63,30) mm Hg and 35,00 (31,50; 40,50) mm Hg, respectively (p<0,05).

It should be also noted that in our study the patients with probable senile asthenia and pre-asthenia were treated mostly conservatively. According to the literature data such patients undergo PCI really less frequently. In particular, this is associated with unfavorable comorbid background in this category

of patients. Past MI, ACVA, AF and peripheral arterial atherosclerosis are met in anamnesis of elderly people with high frequency that coincides with the results of our study [18, 19]. Some researchers have found that the probability of the successful use of invasive diagnostic and therapeutic interventions is significantly lower in elderly people, and therefore, there is a high risk of adverse outcomes and complications [20]. However, currently, many studies have shown an advantage of invasive strategy for the improvement of the prognosis in elderly and senile patients with MI [21]. Regarding to the duration of hospital stay, in our study we obtained no reliable differences between the patients depending on an outcome, that indicates the inexpediency of unjustified prolongation of hospitalization.

We found that the patients older than 70 years with probable SAS and pre-asthenia have a worse prognosis of SAS onset during 12 months after MI. According to our data, the survival rate during a year after MI in patients older than 70 years is ~60%, that also does not contradict the literature data [22]. The data we obtained showed that when scoring ⩾3 points by the screening questionnaire "Age is not a hindrance", the risk of CVD during a year after MI in the patients was higher on average by 72%. According to the literature data this indicator is at the same level, and the risk of general lethality during 3 years increases by 2,5-4 times [23].

It should be noted that severe comorbid pathology worsens prognosis in elderly and senile patients. For example, Rockwood K, et al. consider SAS as a collection of accumulated deficiency of functions against the background of polymorbid pathology [3]. In our study, the presence of probable SAS and pre-asthenia is also associated with more severe comorbid background. The Charlson comorbidity index was reliably higher in the patients of the group I. But the development of SAS is considered as an independent predictor of the adverse outcome in patients with MI of this age category. This gives the possibility to build mathematical models for predicting the risk of the adverse outcome in this category of patients taking into account the presence of SAS and/or the number of points obtained from the screening questionnaire "Age is not a hindrance". The work in this direction seems promising for the improvement of the risk stratification in elderly and senile patients with MI and will be continued by the authors.

Thus, SAS is an important marker of adverse cardiovascular events in patients with MI older than 70 years. In managing elderly and senile patients with MI it is important to assess geriatric state and take it into account when stratifying risk of this category of patients. Treatment and monitoring of these patients should be carried out by a multidisciplinary team of doctors together with a geriatrician. The correction of SAS will contribute to the improvement of outcomes in this category of patients. The limitation of this study may be a small sample size.

## Conclusion

According to the results of the survey of the patients older than 70 years with MI using the questionnaire "Age is not a hindrance", the proportion of the patients scored 0-2 points (without SAS) was 50% (n=46), patients with supposed pre-asthenia (3-4 points) — 32,6% (n=30) and patients with probable SAS (⩾5 points) — 17,4% (n=16). The patients with probable SAS had reliably higher comorbidity level (chronic kidney disease, DM, anemia, stagnant CHF, AF) and the risk of adverse outcomes at the high risk of bleedings. When scoring ⩾3 points by the questionnaire "Age is not a hindrance", the risk of CVD during 12 months in the patients older than 70 years with MI increased by 72%.

**Relationships and Activities:** none.

## References


1. Nurullina GI, Khalfina TN, Abdrakipov RZ, et al. The concept of senile asthenia in the framework of modern gerontology. Practical medicine. 2021;19(4):56-62. (In Russ.) doi:10.32000/2072-1757-2021-4-56-62.
2. Rockwood K, Hogan DB, MacKnight C. Conceptualization and measurement of frailty in elderly people. Drugs and Aging. 2001;17(4): 295-302.
3. Fried LP, Tangen CM, Walston J, et al. Fraity in Older Adults: Evidence for a Phenotype. Journals of Gerontology Series A-Biological Sciences and Medical Sciences. 2001;56(3):146-57.
4. Tkacheva ON, Kotovskaya YuV, Runikhina NK, et al. Clinical guidelines on frailty. Russian Journal of Geriatric Medicine. 2020;(1):11-46. (In Russ.) doi:10.37586/2686-8636-1-2020-11-46.
5. Tkacheva ON, Kotovskaya YuV, Runikhina NK, et al. Clinical guidelines frailty. Part 2. Russian Journal of Geriatric Medicine. 2020;(2): 115-30. (In Russ.) doi:10.37586/2686-8636-2-2020-115-130.
6. Tkacheva ON, Runikhina NK, Ostapenko VS, et al. Validation of the questionnaire for screening of senile asthenia syndrome in outpatient practice. Advances in Gerontology. 2017;2:236-42. (In Russ.)
7. Rockwood K, Mitnitski A. Frailty in relation to the accumulation of deficits. J Gerontol A BiolSci Med Sci. 2007;1:722-7.
8. Rolfson DB, Majumdar SR, Tsuyuki RT, et al. Validity and reliability of the Edmonton Frail Scale. Age Ageing. 2006;35(5):526-9.
9. Morley JE, Malmstrom TK, Miller DK. A simple frailty questionnaire (FRAIL) predicts outcomes in middle aged African Americans. J Nutr Health Aging. 2012;16(7):601-8. doi:10.1007/s12603-012-0084-2.
10. Zao A, Magalhaes S, Santos M. Frailty in cardiovascular disease: Screening tools. Rev Port Cardiol. 2019;38(2):143-58. doi:10.1016/j.repc.2018.05.019.
11. Borkhanova EG, Almukhametova AI, Maksudova AN. The prevalence of nutritional disorders and senile asthenia in geriatric patients in the

pre-dialysis stages of CKD. Nephrology. 2019;S(23):22-3 (In Russ.) doi:10.36485/1561-6274-2019-23-5-18-43.
12. Soselia NN, Bagmanova NKh, Villevalde SV. Associations of frailty syndrome with ischemic and hemorrhagic risk in senile patients and centenarians with acute coronary syndrome. Clinical pharmacology and therapy. 2018;27(2):27-32. (In Russ.)
13. Ambrosetti M. Acute coronary syndromes or acute frailty syndromes? European Journal of Preventive Cardiology. 2018;25(17):1811-2. doi:10.1177/2047487318803679.
14. Hermans MPJ, Eindhoven DC, van Winden LAM, et al. Frailty score for elderly patients is associated with short-term clinical outcomes in patients with ST-segment elevated myocardial infarction treated with primary percutaneous coronary intervention. Neth Heart J. 2019;27:127-33. doi:10.1007/s12471-019-1240-7.
15. Crea F. The Atlas of cardiovascular disease in Europe and focus on frailty and cardiovascular risk. European Heart Journal. 2022;42:703-5. doi:10.1093/eurheartj/ehac066.
16. Clinical practice guidelines for Acute ST-segment elevation myocardial infarction. Russian Journal of Cardiology. 2020;25(11):4-103. (In Russ.) doi:10.15829/1560-4071-2020-4103.
17. Barbarash OL, Duplyakov DV, Zateischikov DA, et al. 2020 Clinical practice guidelines for Acute coronary syndrome without ST segment elevation. Russian Journal of Cardiology. 2021;26(4):4449. (In Russ.) doi:10.15829/1560-4071-2021-4449.
18. Patel A, Goodman ShG, Yan AT, et al. Frailty and outcomes after myocardial infarction insights from the CONCORDANCE Registry. J Am Heart Assoc. 2018;7;e009859. doi:10.1161/JAHA.118.009859.
19. De Luca G, Dirksen MT, Spaulding CS, et al. Impact of age on long-term outcome after primary angioplasty with bare-metal or drug-eluting stent (from the DESERT Cooperation). Am J Cardiol. 2013;112:181-6. doi:10.1016/j.amjcard.2013.03.012.
20. Alegre O, Ariza-Sole A, Vidan MT, et al. Impact of frailty and other geriatric syndromes on clinical management and outcomes in elderly patients with non-ST-segment elevation acute coronary syndromes: rationale and design of the LONGEVO-SCA Registry. Clin Cardiol. 2016;39:373-7. doi:10.1002/clc.22550.
21. Cammalleri V, Bonanni M, Bueti FM, et al. Multidimensional Prognostic Index in elderly patients with acute myocardial infarction. Aging Clinical and Experimental Research. 2020. doi:10.1007/s40520-020-01718-6.
22. Alonso Salinas GL, Sanmartin Fernandenz M, Pascual Izco M, et al. Frailty is a short-term prognostic marker in acute coronary syndrome of elderly patients. Eur Heart J Acute Cardiovasc Care. 2016;5:434-40. doi:10.1177/2048872616644909.
23. Salinas GA, Sanmartin M, Inzo MP, et al. The role of frailty in acute coronary syndromes in the elderly. Gerontology. 2018;64(5):422-9. doi:10.1159/000488390.