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Prognosis of elderly patients hospitalized in the cardiac ward

Research Article

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Abstract: Introduction Cardiovascular diseases affect nearly 80% of the elderly, and they are the major cause of death in this population. The aim was to evaluate the clinical profile and prognostic factors for patients aged 80 years and more who have been hospitalized for cardiologic reasons. Material and Methods The study included 100 patients aged 80-91 years (46% men) referred to the Department of Cardiology. We analyzed the reasons and length of hospitalization, clinical factors, results of basic laboratory tests, echocardiography, angiography, comorbidities and number of deaths during the hospitalization and in one year of follow-up. Patients were divided and analyzed, depending on the total mortality rate.Results The most common causes of hospitalization were myocardial infarction (67%) and heart failure (10%). Coronary angiography was performed in 72% of patients and percutaneous coronary intervention in 81%. The most common cause of hospital deaths was myocardial infarction (67%). The proportion of deaths in hospital was 8%, and during a year of observation it was 26%. Deaths were found to be related to ventricular conduction blocks (OR=4.0; P=0.03) and atrial fibrillation (OR=11.15; P=0.04). Conclusions In the elderly hospitalized in cardiac wards, myocardial infarction was the most common cause of hospitalization and hospital death. The mortality rate was high and associated with ventricular conduction blocks and atrial fibrillation.

Keywords: *Geriatrics • Myocardial infarction • Prognosis*

1. Introduction

Almost 80% of the elderly have cardiovascular diseases, which are a major cause of death for both men and women in this group. Studies by the Department of Economic and Social Affairs of the United Nations estimate that in 2050 the proportion of the people more than 80 years old will increase from 13% to 20%. In Poland, according to the Central Statistical Office (GUS), the average life expectancy beyond the age of 80 years is 6.91 years for men and 8.28 years for women [1]. Chronic morbidity averages 3.8 units per person, with restrictions on mobility in 25% of all elderly people [2].

The most important difficulty is finding the best treatment for elderly persons with cardiovascular diseases, almost always having many diseases and a high risk of functional physical disability. Health problems in the elderly overlap with age-related changes. Aging is associated with complex and diversified changes of the cardiovascular structure and function. Gradually progressive damage to the endothelium associated with atherosclerotic plaque is responsible for the increasing incidence of acute coronary events and strokes [3]. The aorta and major elastic arteries become stiffer, and this leads to increased pulse pressure and increased incidence of isolated systolic hypertension. At the same time the heart muscle cells become hypertrophic and less susceptible to beta-adrenergic stimulation, and the mitochondria lose their ability to produce ATP. Loss of cells, fibrosis and calcification causes structural changes in the conductive system and increases the risk of arrhythmias [4]. All these pathophysiological processes occurring in the elderly cause heart failure in the majority of these patients.

Also, the psychological condition of the elderly has a significant influence on the morbidity of seniors. Most older patients hospitalized in a cardiac ward showed at least one major geriatric syndrome (MGS) on admission, like frailty, cognitive impairment, severe dependence and de-

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pression, which was associated with poorer functional and clinical outcomes and a higher 12-month mortality rate [5]. Another determinant is a change in economic and social conditions (family, social, welfare). These elements are reflected in the elderly patient's attitude towards his own illness and have an impact on the results of therapy [6,7].

In addition, there are no official guidelines regarding treatment of cardiovascular diseases for octogenarians and nonagenarians. These patients are poorly represented in randomized clinical trials by diagnosis, treatment and prognostic factors, and most of the data comes from the registries. Therefore, in the present study we aimed to scan the clinical profile and assess prognostic factors for elderly patients aged 80 years and more who were hospitalized in the cardiac ward.

2. Materials and methods

2.1 Materials

The study involved 100 consecutive patients during a period of 9 months at age 80 years or more who were hospitalized in the Department of Cardiology Medical University of Lodz with access to a catheterization laboratory. We analyzed the reasons and length of hospitalization, terms of admission to the ward (acute and non-acute) and definitive diagnosis. Next we analyzed selected risk factors (gender, body mass index [BMI], arterial blood pressure, smoking status, diabetes, lipid disorders), basic laboratory tests (glomerular filtration rate, white blood cells, hemoglobin, sodium levels and lipid levels) and selected biomarkers, including high sensitivity troponin T (hs TnT) and high-sensitivity C-reactive protein (hs-CRP). In addition, the following parameters were analyzed: 12-lead standard electrocardiography (ECG) (heart rhythm: sinus rhythm or atrial fibrillation, heart rate, the ventricular conduction abnormalities such as left or right bundle branch blocks), results of echocardiography (ejection fraction [EF], hypertrophy of left ventricle, wall motion abnormalities, diastolic dysfunction and valvular defects) and cardiac catheterization, methods of treatment and the presence of comorbidities. Patients were followed with observation for one year by telephone contact.

We analyzed patients depending on the total mortality rate.

The study was approved by the Bioethical Committee of the Lodz Medical University.

2.2 Statistical analysis

Calculations were performed using the statistical package STATISTICA PL 9.0. Quantitative variables were characterized using the basic descriptive statistics: number of observations (N), mean, median, minimum (Min) and maximum (Max) values, the first (Q25) and third (Q75) quartiles, standard deviation (SD) and verification of the hypothesis of normal distribution using the Shapiro-Wilk test of normality. In the case of qualitative variables, each category was assigned a variable number of observations with a given variant (N) and the corresponding percentage.

To investigate whether patients in groups distinguished by death varied significantly due to the quantitative variables, Student's t test was used (if the variable distribution was normal in both groups) and Mann – Whitney's test (in the absence of normal distribution). The independent chi-square test was used to investigate whether relationship existed between death and the various qualitative variables. To identify independent variables for death the uni- and multivariate regression analyses were performed. P value <0.05 was considered statistically significant.

3. Results

The enrolled patients (54 women, 46 men) were aged 80-91 years (average age 83+/-2.56 years, Med 82). In 82% of the patients the cause of hospitalization was chest pain; next was shortness of breath (12%); and in 6% it was other causes such as hypertension or loss of consciousness. The most common admission to the ward was an acute term (82%). The definitive diagnosis is presented in Figure 1.

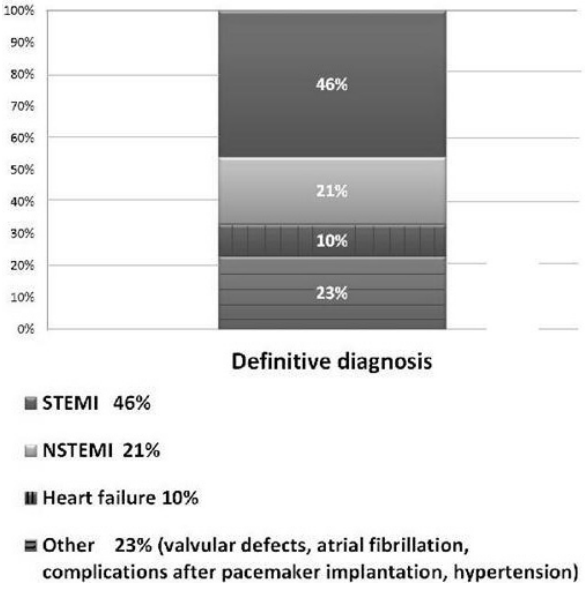

Figure 1. The definitive diagnosis. STEMI - myocardial infarction with ST-segment elevation, NSTEMI - myocardial infarction without ST-segment elevatio.

Coronary angiography was performed in 72% of the patients, including PCI with bare-metal stents (BMS) implantation in 76%, percutaneous balloon angioplasty (POBA) in 5% and no intervention in 19%. The opening of the coronary artery was not achieved in 7 patients (9.2%). Multivessel 2- or 3-coronary artery disease was documented in 88%, including left main disease in 5%. One-vessel coronary artery disease was found in 11% of patients and marginal plaques in only 1% of patients. The form of therapeutic treatment in the total studied population is presented Figure 2.

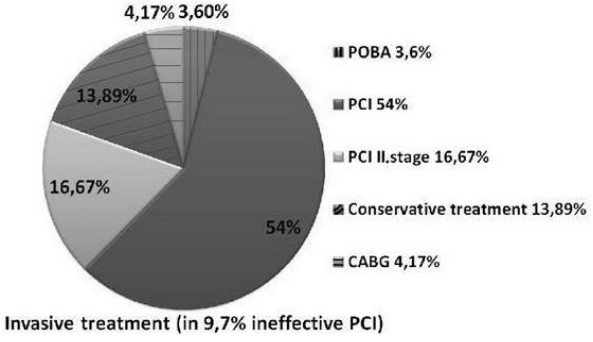

Figure 2. Form of therapeutic treatment. POBA - percutaneous balloon angioplasty, PCI - percutaneous coronary intervention, CABG - coronary artery bypass graft.

A common phenomenon was the coexistence of other diseases and polypharmacy. Most patients in the study (37%) had lung disease (chronic obstructive pulmonary disease 15%, pneumonia or acute bronchitis 17%, tuberculosis 3% and asthma 2%); 22% had chronic renal failure, and 9% had cancer. The patients used an average of 7.68 drugs daily (max 15, min 3).

Fifty three patients who could not be reached by telephone or did not agree to the follow-up were not included in the one-year observation. Patients who died differed from the others in the frequency of the ventricular conduction blocks (50% vs 20%, P=0.03), atrial fibrillation (27.8% vs 3.3%, P=0.02) and the level of HDL (47.75+/-18.20 vs 57.17+/-15.75, P=0.04). Characteristics of the groups in the study are shown in Tables 1-3. The proportion of deaths in the hospital and deaths during a year of observation was 8% and 26%, respectively. Figure 3 shows the total mortality according to the acute versus non-acute way of admission to hospital. The most common cause of hospital deaths was myocardial infarction (67%): STEMI in 87.5% of patients and NSTEMI in 12.5%. The cause of death during a year of follow-up was unknown to 50% of the patients' families, whereas in 30% the cause was cardiovascular, and in 20% noncardiac (pneumonia - 10%, leukemia - 10%). In patients discharged from hospital who died during a year of observation and who had atrial fibrillation, the cause of death in 25% was cardiovascular, noncardiac

Table 1. Clinical and electrocardiographic characteristics of the studied groups.

	The dead	Living patients	P
Clinical characteristics			
Male sex [%]	61.11	40.00	0.16
Age [years]	83.06+/-2.86 (80-89)	82.10+/-2.34 (80-91)	0.28
Hospitalization [days]	6.89± 3.20	6.97± 2.65	0.93
Acute term of admission [%]	88.89	90.00	0.90
Reason of admission- myocardial infarction [%]	66.67	73.33	0.62
Reason of admission- heart failure [%]	28.00	17.00	0.78
BMI [kg/m^2]1	26.85± 4.23 (24.22-28.89)	26.58± 3.43 (23.26-29.25)	0.82
Smoking status [%]	11.11	26.67	0.19
Hypertension [%]	72.22	93.33	0.11
Diabetes [%]	50.00	36.67	0.36
Lipid disorders [%]	27.77	31.03	0.81
Co-morbidity [%]	66.67	60.00	0.64
Pulmonary diseases [%]	22.22	24.14	0.88
Neoplasms [%]	5.56	10.34	0.57
Electrocardiography (ECG)			
Heart rate /min	85.61+/-46.57 (65-90)	78.87+/-25.46 (60-90)	0.76
Atrial fibrillation [%]	27.77	3.45	0.015
Ventricular blocks [%]	50.00	20.00	0.029

1 BMI - body mass index.

Table 2. Biochemical characteristics of the studied groups.

	The dead	Living patients	P
Biochemical characteristics			
GFR [ml/min/1,73m^2]1	49.07± 31.07 (23.72-83.33)	52.80± 17.89 (37.89-59.34)	0.12
White blood cells [10^3/ul]	11.8± 5.9 (6.5-16.4)	8.61± 2.70 (6.7-9.9)	0.19
Hemoglobin [g/dl]	12.56+/-2.22 (11.8-13.8)	11.98+/-2.33 (10.8-13.4)	0.30
Low-density lipoprotein [mg/dl]	99.56+/-33.32 (69.5-131)	101.10+/-38.89 (72-132)	0.89
High-density lipoprotein [mg/dl]	47.75+/-18.20 (34-58.5)	57.17+/-15.75 (48-66)	0.04
Triglyceride [mg/dl]	106.06+/-40.31 (80.5-117.5)	125.67+/-72.16 (76-161)	0.49
hsTnT [ng/ml]2	1.99±3.63 (0.04-2.49)	1.71±2.8 (0.06-2.83)	0.58
hsCRP [mg/l]3	85.46+/-130.50 (2.7-109.2)	25.31+/-45.17 (2.5-23.4)	0.29
D-dimer [pg/ml]	2.25+/-1.87 (1.04-3.47)	0.85+/-0.51 (0.52-0.88)	0.06

1 GFR - glomerular filtration rate,
2 hsTnT- high sensitivity troponin T,
3 hsCRP- high snsitivity C-reactive protein.

Table 3. Echocardiographic and angiographic characteristics of the studied groups.

	The dead	Living patients	P
Echocardiography			
Akinesis/hipokinesis [%]	61.11	60.00	0.94
Diastolic relaxation disturbances [%]	5.56	3.33	0.71
EF [%][1]	46.13± 16.57 (30-55)	55.82± 10.00 (48-64)	0.056
Cardiac hyperthrophy [%]	16.66	31.03	0.27
Valvular defects [%]	27.78	34.48	0.63
Coronary angiography			
Cardiac catheterization [%]	55.56	76.67	0.13
Left main coronary artery disease [%]	11.11	6.67	0.59
PCI [%][2]	33.33	62.07	0.06
POBA [%][3]	11.11	10.34	0.93
PCI+POBA [%]	44.44	62.07	0.24
II. stage of PCI [%]	11.11	20.69	0.39
CABG [%][4]	0	6.897	0.25

1 EF- ejection fraction,
2 PCI- percutaneous coronary intervention
3 POBA- percutaneous balloon angioplasty
4 CABG- coronary artery bypass graft.

in 50% (leukemia - 25%, pneumonia - 25%), and in 25% the cause was unknown.. In patients discharged from hospital who died and had ventricular conduction blocks, in 75% the cause of death was cardiovascular and in 25% the cause was unknown.

Death was related to ventricular conduction blocks (OR=4.0; 95%CI 1.14-13.98; P=0.03) and atrial fibrillation (OR=11.15; 95%CI 1.66-75.08; P=0.04). Variables identified as significant in the univariate analysis were included in the multivariate model of logistic regression. Despite the statistical significance for the entire model (χ_2=11.26; P<0.05), multivariate regression analysis did not reveal an independent variable for death of the patients (Table 4).

Table 4. Results of multivariate regression analysis.

Variables	B – estimate parameter	Standard error (SE)	P	Exp (B) (OR)	-95%CI	+95%CI
EF	-0.064	0.039	0.099	0.938	0.869	1.012
Atrial fibrillation	2.234	1.310	0.088	9.338	0.717	121.63
HDL	-0.024	0.034	0.479	0.976	0.914	1.043
Ventricular blocks	-0.229	0.982	0.816	0.795	0.116	5.447
Intercept	3.334	2.274	0.143	28.064		

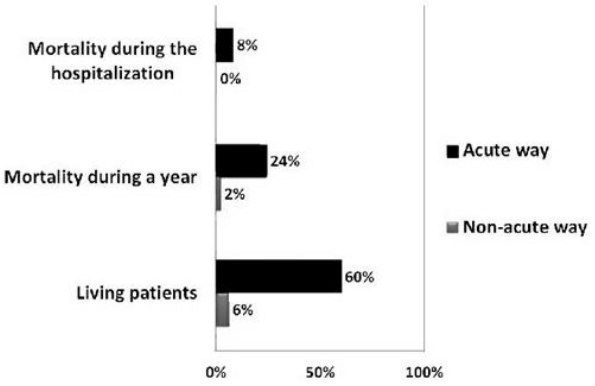

Figure 3. Mortality in groups of patients admitted to hospital in acute versus non-acute way.

4. Discussion

In the community population more than 80 years old in this study, the mortality rate throughout the year of observation was high, with a proportion of 8% in the hospital period and 26% during the observation period. There are a lack of studies about mortality in the oldest population. Mathias et al. concurred that the risk of death increases as age advances for each cardiovascular disease in both sexes in participants aged more than 85 years [8]. Multiple factors contribute to death in older adults, but the extent to which of each of them contribute independently to mortality risk is still unknown. Our study has shown that the association between death and ventricular conduction blocks and atrial fibrillation is similar to that in other studies.

Mogensen et al. analyzed prognostic factors in 825 patients older than 85 years and compared them with those in younger age groups, showing that the long-term mortality risk was associated with atrial fibrillation [HR= 1.30 (1.06-1.60), P=0.013]; prognostic importance was greater in the very elderly, whereas ejection fraction, diabetes [HR=1.31 (1.01-1.61), P=0.04], and renal insufficiency [HR=1.36, P<0.0001] had less prognostic importance than in younger patients (P for interactions <0.003) [9]. Elderly people, especially those with impaired left ventricular function, have a substantial risk of death from congestive heart failure. However, more deaths occur from heart failure in elderly persons with normal systolic function [10].

The association between ventricular conduction block and cardiac mortality risk is well known in patients with cardiac disease and has also been recently documented in the population without known cardiac disease [11]. The conduction blocks potentially identify high-risk patients who need preventive intervention [11].

One of the major characteristics of elderly patients is the presence of multi-morbidity. In our study 62.5% of the elderly were affected by one, two and often more non-cardiac chronic diseases, mainly pulmonary or renal disease and neoplasm. This finding differed from other studies, especially since chronic obstructive pulmonary disease and neoplasms were more common than in a prior study, but renal failure was less frequent [12]. It was noted that the elderly have many chronic diseases, among which cardiovascular, respiratory, central nervous system (CNS), metabolic disorders and cancers predominate [12]. Non-cardiac comorbidities were found in 56.8% of patients in Piçarra's study, with the following prevalences: anemia 18.2%, chronic obstructive pulmonary disease 11.4%, chronic renal failure 25.8%, cancer 3%; neurologic or psychiatric disorders 11.4% and prostatic hyperplasia 20.5% [13]. The very elderly with acute myocardial infarction with comorbidities had a longer hospital stay than those without an acute MI; an invasive strategy, with coronary angiography, was used in 12.1% of patients, with no differences between groups (12.3% in patients without comorbidities and 12.0% in those with comorbidities, P = 0.82) [13]. Coexistence of many chronic diseases can affect elderly patients' clinical condition, causing diagnostic difficulties and a worsening of symptoms and reducing the effectiveness of therapy. Most current guidelines apply the rules of treatment and the prevention to a single chronic disease. Such an approach to the problem is insufficient since the majority of elderly patients have several diseases. One of the most recently discussed hypotheses that is attractive is an effect of a low grade systemic inflammation as a phenomenon essential for the pathogenesis of many chronic diseases in elderly [14].

Similarly, polypharmacy is frequent in the elderly population. In our study there was an average use of 7.68 drugs per patient; in the patients who died during a year of follow-up observation the average was 8.00 drugs and in the patients who survived it was 7.66. On the other hand, elderly patients with serious chronic diseases are often under-treated or not treated at all. In a study conducted in Scotland in 1999-2000 with 2186 patients more than 75 years old, it was shown that the patients were receiving beta-blocker only in 19% of cases and angiotensin-converting enzyme inhibitors (ACEI) only in 33% of cases for treatment of heart failure [15]. Moreover 50% of cases of hospitalizations and worsening of heart failure was caused by discontinuance of drugs or incorrect use of them by patients [16,17]. In a study conducted in 2004 in Poland by Fedyk-Lukasik et al. 70% of patients were aware of the diagnosis, 40-50% knew the effect of the drug and 70% knew how to use the drugs correctly [18].

Moreover, heart failure, which is considered the leading cause of hospitalization in the elderly [19,20], in our observation was not frequent (10%). More often, patients were admitted to the hospital because of myocardial infarction (NSTEMI 21%, STEMI 46%), which can be related to the department specificity and to the fact that the hospital was equipped to perform invasive therapy in acute coronary syndromes.

In elderly patients the manifestation of coronary artery disease is usually silent. It is likely due to the reduced perception of pain caused by many factors, primarily the dysfunction of the autonomic nervous system, a disorder of carbohydrate metabolism and the ischemic damage of sensory nerve fibers [21]. According to the National Registry of Myocardial Infarction, ischemia without chest pain occurs in up to 40% of people after the 85th year of age and in 77% of patients less than 65 years of age [22]. In our study 97% of patients with NSTEMI or STEMI had chest pain, which might be associated with the preselection of patients by the ambulance team that provided these initial diagnoses of myocardial infarction to a catheterization laboratory. Dyspnoea was the manifestation of myocardial infarction in only one patient and syncope in another.

Patients with NSTEMI in old age are rarely referred for coronary angioplasty, which is confirmed by analysis of 18,466 patients with myocardial infarction without ST segment elevation who were enrolled in the GRACE registry [23]. They were high-risk patients, with dynamic ST-segment changes and / or elevated values of markers of myocardial necrosis. These patients were divided into 3 groups: younger (<70 years), elderly (>80 years) and the oldest, aged >85 years. Invasive treatment was less common in older and the oldest patients. The coronary angiography was performed in 67% of patients less than 70 years of age, in 55% of people over 80 years old and only in 33% of patients in the oldest age group. Percutaneous revascularization was performed in 38% of those in the youngest group, 28% after the age of 80 and 18% of the oldest, with surgical revascularization in 7.2%, 7.3% and 3.1%, respectively. In our study coronary angiography was performed often in patients over 80 years old with NSTEMI (in 80.9% and percutaneous revascularization in 71.4%, with surgical revascularization in 4.8%).

However, patients with STEMI require reperfusion therapy as soon as possible. Benefits of the coronary angioplasty with restoration of the flow in the infarct-related artery are enormous, regardless of age. Shah et al. assessed the outcomes and quality of life in 73 patients above the 85th year who had a myocardial infarction with ST segment elevation [24]. Coronary angiography was performed in 89% of patients, and 70%

were treated with the primary coronary angioplasty. Primary angioplasty was the only independent predictor of survival. The only independent factor increasing mortality risk was cardiogenic shock, which was found in 30% of patients. In our study coronary angiography was performed in patients with STEMI who were more than 80 years old in a similar percentage (89.1%), while PCI was performed more often, in 82.6% of cases.

The TIME study (involving over 300 patients more than 75 years old), which compared conservative and invasive treatment of chronic symptomatic coronary artery disease, has shown that PCI not only improves the quality of life, but also reduces the incidence of death, myocardial infarction, and re-hospitalization for cardiovascular causes in the year of observation [25]. However, the risk of periprocedural complications associated with PCI increases several times with age. The risk of death during PCI has grown by 1% for every additional 10 years of age, and at the same time the risk of death during CABG has grown by 2%, depending on the patient's condition, cardiac-related state and type of surgery [26]. The BARI study showed that CABG is an effective method of treating angina in elderly patients, with significantly less recurrence than after PCI [27]. However, the surgery was associated with three-to-five-fold increased risk of stroke compared with PCI, and the risk of death due to perioperative cardiovascular complications is 7-fold higher after the 80th year than it is in patients up to 60 years who undergo CABG [28].

4.1 Limitations of the study

Our study has several limitations. First, the study population was relatively small (particularly the population in follow-up), which was connected with the period of the enrollment. The size of the population probably influenced the multivariate results. Moreover, the participants were preselected based on the fact that the hospital performed invasive therapy in acute coronary syndromes. Second, it was a hospital-based, short-term study. To evaluate the risk factors for elderly patients hospitalized in cardiology departments, more study settings should be included. Clearly, there is a need for further investigation of these issues in more than one center to compare the results and provide generalized conclusions.

In conclusion, the clinical profile of elderly patients hospitalized in the cardiac ward was heterogeneous. Myocardial infarction was the most common cause of hospitalization and hospital deaths. Mortality rates throughout the observation period were high despite invasive diagnosis and revascularization in most cases, and they were associated with ventricular conduction block and atrial fibrillation.

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