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ORIGINAL ARTICLE

Long-term prognosis following acute coronary syndromes: a prospective observational study of an unselected group treated in the 24/7 cardiac catheterisation laboratory at a university hospital

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Abstract

Background: Risk stratification in acute coronary syndrome (ACS) is usually based on clinical data obtained during hospitalisation. To date, there is a limited number of prospective observational studies assessing long-term prognosis of patients discharged from hospital after ACS.

Aim: This study is to investigate long-term follow-up of unselected ACS patients treated at the 24-hour/7-day (24/7) cardiac catheterisation laboratory and discharged from referral university hospital.

Methods: We studied 672 consecutive ACS patients (median age 61 years, 66.7% men) hospitalised and discharged between 2002 and 2004. The analysis was done in respect of the type of ACS, i.e. non-ST-segment elevation: unstable angina non-ST-segment elevation myocardial infarction (UA/NSTEMI; n = 255) vs. ST-segment elevation myocardial infarction (STEMI; n = 417). All patients underwent coronarography and, if indicated, primary angioplasty (417 patients with STEMI and 157 patients with UA/NSTEMI). The primary endpoint was defined as all-cause mortality during six years of follow-up. Survival status and date of death were obtained from the National Death Registry of Poland and presented as Kaplan-Meier survival curves.

Results: Despite a significantly higher one-year mortality of patients with UA/NSTEMI compared to those with STEMI (7.1% vs. 3.1%, p = 0.018), the overall mortality assessed throughout follow-up until 2009 was comparable between UA/NSTEMI and STEMI patients (18.8% vs. 18%, p = 0.79).

Conclusions: The long-term (several years) survival did not depend on the type of ACS.

Key words: acute coronary syndrome, long-term risk, prognosis, discharge

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INTRODUCTION

Acute coronary syndrome (ACS) represents a major healthcare burden worldwide. The diagnosis and management of unstable angina (UA), non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI) have been rapidly evolving in recent years [1]. However, ACS continues to be a significant health problem throughout the world, being responsible for a substantial number of deaths due to cardiovascular diseases (CVDs) [2]. The status of Middle Eastern nations in this context is especially worrying, because, according to a prediction by the World Health Organisation, they will face the greatest increment in the absolute burden of CVD in the world [3, 4]. Based on the National Database of ACS in 2009–2012, the number of people admitted to hospital with ACS varied within the range of 77,200 in 2009 to 79,400 in 2012. The overall one-year and

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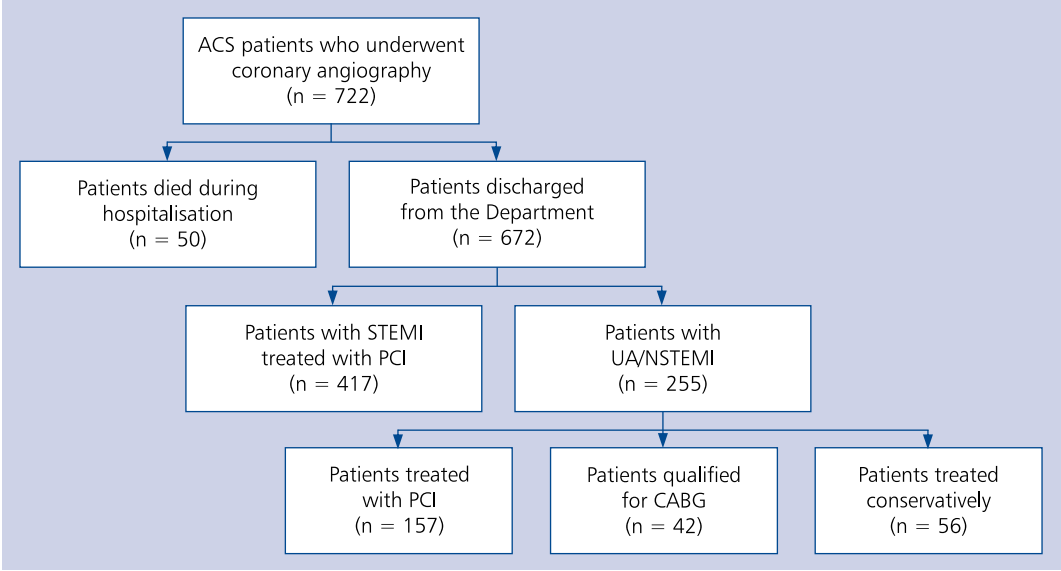

Figure 1. Scheme for the qualification of patients for analysis; CABG — coronary artery bypass grafting; ACS — acute coronary syndrome; PCI — percutaneous coronary intervention; STEMI — ST-segment elevation myocardial infarction; UA/NSTEMI — unstable angina/non-ST-segment elevation myocardial infarction

three-year mortality after hospital discharge ranged between 19.4% and 28.2%, respectively [5]. The risk stratification in ACS is usually based on the clinical data obtained during hospitalisation. To date, there is a limited number of prospective observational studies assessing long-term prognosis of patients discharged from hospital after ACS. The aim of this study was long-term follow-up of unselected ACS patients treated at the 24-hour cardiac catheter laboratory and discharged from referral at a university hospital.

METHODS

Study description

We performed a single-centre, prospective study of consecutive patients with any type of ACS hospitalised between 2002 and 2004 in our Department in a 24-hour/7-day (24/7) catheter laboratory. All patients underwent coronary angiography and, if indicated, percutaneous coronary intervention (PCI). The analysis included only those patients who were discharged alive from hospital. The scheme for the qualification of patients for the analysis is presented in Figure 1. The Third Universal Definition of Myocardial Infarction was used in our publication. The patients were classified as having STEMI or UA/NSTEMI, according to current guidelines:

— STEMI: presence of ST-segment elevation of ≥ 0.2 mV in men ≥ 40 years old, ≥ 0.25 mV in men < 40 years old, ≥ 0.15 mV in women in V2–V3 leads and/or ST-segment elevation of ≥ 0.1 mV in two or more standard leads or new left bundle branch block and positive cardiac necrosis markers;

— UA/NSTEMI: presence of ST-segment depression of ≥ 0.05 mV in two or more standard leads or T-wave flattening or inversion and positive cardiac necrosis markers.

Ethical committee approval was obtained before initiation of the study and all patients provided informed consent.

Data management

Patients' data regarding demographic characteristics, medical history, cardiovascular risk factors, clinical presentation, time of symptom onset, early in-hospital management, reperfusion treatment, findings of diagnostic tests, hospital length of stay, discharge and intra-hospital medications, and follow-up survival data until August 2009 were collected.

The obtained data were entered into an electronic database created by the author (M.G.) in the MS-Access database management system. The programme, based on the data, automatically calculated the number of points according to the risk scores for stratification of ACS i.e. SIMPLE, TIMI STEMI, TIMI UA/NSTEMI, GRACE EXTRA-EXPRESS, GRACE EXCESS, ZWOLLE, and LLOYD-JONES.

Study endpoints

The primary endpoint was defined as all-cause mortality during six years of follow-up. Survival status and date of death were obtained from the National Death Registry of Poland and presented as Kaplan-Meier survival curves.

Significant bleeding was defined using Thrombolysis in Myocardial Infarction and GUSTO Bleeding Definitions, i.e. as occurrence of intracranial haemorrhage or ≥ 5 g/dL decrease

in the haemoglobin concentration or ≥ 15% absolute decrease in haematocrit.

Statistical analysis

Group comparisons were performed using the t test or the Mann-Whitney U test for continuous variables, and Fisher's or χ^2 test for categorical variables. The Shapiro-Wilk test was used to assess the distribution normality of the tested variables. The Kruskal-Wallis test was used to compare two or more independent samples of equal or different sample sizes. Statistical significance was set at $p < 0.05$.

Survival of patients from the time of discharge was presented using Kaplan-Meier curves, and group comparisons were made using a log-rank test.

Statistical analysis was performed using MS Windows XP Professional, MS Office 2003 Professional, Statistica 9 PL, and SAS Software 9 (SAS Institute, Cary, NC, USA).

RESULTS

Out of 722 ACS patients who underwent coronary angiography, 50 patients were excluded from the current analysis because of death during hospitalisation. Finally, the study group comprised 672 patients at a median age of 61 (52–70) years, 448 (66.7%) of whom were men. A total of 417 (62.05%) patients were diagnosed with STEMI, and all of them were treated with PCI. The rest of the group, i.e. 255 (37.95%) patients, presented UA/NSTEMI — 157 (61.57% of all UA/NSTEMI) patients were treated with PCI, 42 (16.47%) were qualified for coronary artery bypass graft surgery (CABG), and 56 (35.67%) were treated conservatively. Detailed characteristics of the STEMI and the UA/NSTEMI groups are presented in Table 1.

Throughout the observational period, out of 672 patients, 123 patients died. The maximum observation time of a patient who was alive at the end of the observation was 2772 days and the minimum was 1939 days. In the group of patients who died at the end of follow-up, the maximum follow-up time was 2591 days and the minimum was death on the day of hospital discharge. Median follow-up time for the study group was 2443 days, and this did not differ between subgroups: STEMI — 2435 and UA/NSTEMI — 2471 days ($p = 0.074$) (Table 2).

The mortality of patients with STEMI and UA/NSTEMI in subsequent follow-up periods following hospital discharge is presented in Table 3. Despite a significantly higher one-year mortality of patients with UA/NSTEMI compared to those with STEMI (7.1% vs. 3.1%, $p = 0.018$), the overall mortality assessed throughout follow-up until 2009 was comparable in UA/NSTEMI and STEMI patients (18.8% vs. 18%, $p = 0.79$). The Kaplan-Meier analysis of the both groups, seen in Figure 2, demonstrated no statistical difference in survival (log-rank test, $p = 0.789$). The hazard ratio of death was 1.06 (95% confidence interval 0.74–1.53; $p = 0.75$).

DISCUSSION

The true natural history of ACS is hard to establish for a number of reasons, including the common occurrence of silent infarction, the frequency of sudden death outside the hospital, and the varying methods and definitions used in the diagnosis of the condition. Community studies have consistently shown that the overall case fatality rate of patients with presumed ACS in the first month is ~50%, and of these deaths about half occur within the first 2 h [6]. This high initial mortality seems to have altered little over recent years in contrast to hospital mortality [7]. Prior to the introduction of coronary care units in the 1960s, the in-hospital mortality seemed to range 25%–30%. A systematic review of mortality studies in the pre-reperfusion era of the mid-1980s showed an average in-hospital fatality of ~16%. With the widespread use of coronary interventions, fibrinolytic agents, antithrombotic therapy, and secondary prevention, the overall one-month mortality has since been reduced to 4%–6%, at least in those who participated in the recent randomised large-scale trials and were eligible for fibrinolysis and/or coronary interventions [8, 9]. However, mortality rates in registry studies are much higher, suggesting that the patients included in the randomised studies [10] are at a lower risk when compared with those seen in the real world.

In the present study, out of 722 hospitalised patients with ACS, 50 (6.9%) patients died during the in-hospital phase, 99 (14.7%) during follow-up of five years, and 123 (18.3%) at the end of observation. This long-term study demonstrates very similar outcomes to those of the GRACE UK-Belgian Study. In the two country cohorts, during the initial in-hospital phase, 3% of the United Kingdom and 4% of the Belgian cohorts died, and during follow-up of five years 18% (United Kingdom) and 15% (Belgium) died [11].

According to other published data — from the register of Silesian PL-ACS — in-hospital mortality in STEMI was 9.3%, in UA it was 0.8%, and in NSTEMI it was 6.6%. Patients with UA had a low number of complications, and a composite outcome (death, myocardial infarction [MI], or stroke) occurred in 1.3% of them. Usually analysed together with UA as NSTE-ACS, NSTEMI patients had several times worse outcome than UA patients. The rates of complications were much closer to those reported for STEMI patients. The NSTEMI patients had lower mortality (6.6% vs. 9.3%, $p < 0.001$), higher rates of recurrent MI (5.6% vs. 3.8%, $p < 0.001$), and similar incidence of stroke (0.6% vs. 0.7%, $p = 0.057$) in comparison with STEMI patients [12].

Further data on long-term patient prognosis after ACS are available [13, 14] and also continuously updated on websites of surveys (http://pl-acs.sccs.pl). According to them, in the first phase of the study, mean mortality during six months after discharge was 4.8% in UA, 16.1% in NSTEMI, and 17.1% in STEMI, and after two years of follow-up, the mortality rate in NSTEMI was 26% and in STEMI it was 23% ($p < 0.001$).

Table 1. Detailed characteristics of the study group

	All	STEMI	UA/NSTEMI	P
Number of patients	672	417	255	
MEDICAL HISTORY				
Age [years]	60.8 ± 10.9 61 [52–70]	59.6 ± 11 59 [51–69]	62.7 ± 10.6 63 [54–72]	**0.0003**
Men	448 (66.7%)	295 (70.7%)	153 (60%)	**0.004**
Time since the symptom onset [h]	5.6 ± 8.2 3 [2–6]	5.4 ± 7.6 3 [2–6]	6.3 ± 10.7 3 [2–6]	0.34
Angina pectoris de novo < 2 weeks	234 (34.8%)	182 (43.6%)	52 (20.4%)	**< 0.001**
Angina pectoris de novo > 2 weeks < 2 months	47 (7%)	22 (5.3%)	25 (9.8%)	**0.026**
Angina pectoris de novo < 2 months	281 (41.8%)	204 (48.9%)	77 (30.2%)	**< 0.001**
Arterial hypertension	395 (58.8%)	215 (51.6%)	180 (70.6%)	**< 0.001**
Diabetes	101 (15%)	53 (12.7%)	48 (18.8%)	**0.031**
Dyslipidaemia	240 (35.7%)	112 (26.9%)	128 (50.2%)	**< 0.001**
Smoking	271 (40.3%)	203 (48.7%)	68 (26.7%)	**< 0.001**
Previous MI	165 (24.6%)	74 (17.7%)	91 (35.7%)	**< 0.001**
PCI	39 (5.8%)	16 (3.8%)	23 (9%)	**0.005**
CABG	22 (3.3%)	9 (2.2%)	13 (5.1%)	**0.038**
Previous stroke	31 (4.6%)	19 (4.6%)	12 (4.7%)	0.93
Chronic heart failure, NYHA class III/IV	21 (3.1%)	10 (2.4%)	11 (4.3%)	0.17
PAD	62 (9.2%)	28 (6.7%)	34 (13.3%)	**0.004**
Asthma/COPD	35 (5.2%)	17 (4.1%)	18 (7.1%)	0.09
SCA prior to hospitalisation	20 (3%)	16 (3.8%)	4 (1.6%)	0.09
CLINICAL EXAMINATION				
HR [bpm]	76.6 ± 16.1 76 [65.75–85]	76.3 ± 15.8 75 [65–86]	77 ± 16.8 76 [66.5–83]	0.87
SBP [mmHg]	134.3 ± 27.1 130 [120–150]	130.1 ± 26.5 130 [110–143]	141.1 ± 26.8 140 [120–150]	**< 0.001**
DBP [mmHg]	78.7 ± 14.8 80 [70–90]	77.1 ± 15.1 80 [70–90]	81.4 ± 13.9 80 [70–90]	**0.0003**
Pulmonary oedema, Killip class:				0.17
I	605 (90%)	367 (88%)	238 (93.3%)	
II	58 (8.6%)	43 (10.3%)	15 (5.9%)	
III	4 (0.6%)	3 (0.7%)	1 (0.4%)	
IV	5 (0.7%)	4 (1%)	1 (0.4%)	
Pulmonary oedema, Killip class II–IV	67 (10%)	50 (12%)	17 (6.7%)	**0.025**
Pulmonary congestion, Killip class III–IV	9 (1.3%)	7 (1.7%)	2 (0.8%)	0.49
Height [cm]	169.2 ± 8.9 170 [163–176]	169.6 ± 8.4 170 [164–176]	168.4 ± 9.8 168 [160–176]	0.12
Weight [kg]	79.6 ± 24 78 [70–86]	80.2 ± 27.8 78 [70–88]	78.5 ± 14.9 77 [70–85]	0.42
ECG				
ST-segment elevation	417 (62.1%)	417 (100%)	0 (0%)	**< 0.001**
ST-segment depression	336 (50%)	210 (50.4%)	126 (49.4%)	0.8115
Negative T waves	187 (27.8%)	82 (19.7%)	105 (41.2%)	< 0.001
Sinus rhythm	624 (92.9%)	385 (92.3%)	239 (93.7%)	0.49
ST elevation in leads II, III, and aVF	244 (36.3%)	244 (58.5%)	0 (0%)	**< 0.001**
ST elevation in leads V1–V4	164 (24.4%)	164 (39.3%)	0 (0%)	**< 0.001**

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Table 1 (cont.). Detailed characteristics of the study group

	All	STEMI	UA/NSTEMI	P
LBBB	12 (1.8%)	6 (1.4%)	6 (2.4%)	0.39
RBBB	23 (3.4%)	13 (3.1%)	10 (3.9%)	0.58
LABORATORY TESTS				
First measurement of cardiac troponin I [ng/mL]	21.3 ± 70 2.2 [0.1025–14.675]	27.2 ± 83.7 2.9 [0.2–21.5]	11.6 ± 36 1.41 [0–10.5]	**0.0008**
Maximum cardiac troponin I [ng/mL]	65.4 ± 132.5 18.4 [1.6–50]	93.4 ± 156.9 50 [6.5–50]	19.4 ± 50.7 4.4[0.29–20.3]	**< 0.001**
Maximum CK-MB isoenzyme [U/L]	155.1 ± 172.4 98 [24–228]	213.2 ± 184.7 167 [78–281]	55.7 ± 81.1 21 [11–60.3]	**< 0.001**
Total cholesterol [mg/dL]	190.9 ± 45.8 189 [155–220]	190.9 ± 43.1 190 [159–220]	191 ± 50.1 188 [152–221]	0.46
LDL cholesterol [mg/dL]	114.1 ± 38.6 112 [83–141]	115.7 ± 37.3 115 [86–142]	111.5 ± 40.6 103 [81–136]	0.10
HDL cholesterol [mg/dL]	45.2 ± 14.4 43 [36–52]	45.5 ± 13.9 43 [36–53]	44.8 ± 15.1 43 [36–51]	0.47
Triglicerides [mg/dL]	154 ± 92.2 132 [100–178]	146.5 ± 78.5 127 [96–169]	166.4 ± 110.2 142 [108–186]	**0.007**
CRP [mg/L]	29.9 ± 56.3 10.8 [4.6–28.2]	33.5 ± 63.3 12.75 [5.1–30.9]	22.9 ± 39 7.4 [4.2–22.9]	**0.001**
Creatinine [mg/dL]	1 ± 0.5 0.94 [0.8–1.11]	1 ± 0.4 0.92 [0.79–1.10]	1.1 ± 0.6 0.96 [0.84–1.16]	**0.025**
eGFR [mL/min/1.73 m^2]	88.1 ± 35.1 85 [66–107]	92 ± 36.4 88 [69–109]	80.9 ± 31.3 78 [57–101]	**0.0006**
eGFR < 60 [mL/min/1.73 m^2]	104 (15.5%)	51 (12.2%)	53 (20.8%)	0.003
MDRD [mL/min/1.73 m^2]	80.7 ± 24.6 80 [65–95]	83.9 ± 24.9 83 [68–98]	75.2 ± 23.1 76 [62–89]	**< 0.001**
RISK ASSESSMENT SCALES				
SIMPLE score	22 ± 10 20 [15–27]	22 ± 10 20 [15–27]	22 ± 9 21 [16–27]	0.2706
TIMI score for UA/NSTEMI			3.4 ± 1.4 3 [2–4]	NA
TIMI score for STEMI		2.9 ± 2 3 [1–4]		NA
GRACE score for intra-hospital mortality	123 ± 28 122 [103–142]	129 ± 27 128 [112–147]	114 ± 27 113 [94–129]	**< 0.001**
GRACE score for post-discharge risk mortality	95 ± 26 93 [75–112]	91 ± 25 88 [73–110]	102 ± 27 100 [82–122]	**< 0.001**
ZWOLLE score		3 ± 2 2 [1–4]		NA
LLOYD score			8 ± 4 8 [6–10]	NA
INTERVENTION DATA				
MV-CAD	204 (30.4%)	102 (24.5%)	102 (40%)	**< 0.001**
LM stenosis	8 (1.2%)	7 (1.7%)	1 (0.4%)	0.27
LAD stenosis	220 (32.7%)	154 (36.9%)	66 (25.9%)	**0.003**
LCx stenosis	73 (10.9%)	35 (8.4%)	38 (14.9%)	**0.009**
RCA stenosis	263 (39.1%)	211 (50.6%)	52 (20.4%)	**< 0.001**

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Table 1 (cont.). Detailed characteristics of the study group

	All	STEMI	UA/NSTEMI	P
TIMI flow before PCI	0.8 ± 1.2 0 [0–2]	0.4 ± 0.9 0 [0–0]	1.7 ± 1.3 2 [0–3]	< 0.001
TIMI flow after PCI	2.8 ± 0.7 3 [3–3]	2.7 ± 0.7 3 [3–3]	2.8 ± 0.6 3 [3–3]	0.054
Coronary angioplasty	574 (85.4%)	417 (100%)	157 (61.6%)	< 0.001
POBA	121 (18%)	82 (19.7%)	39 (15.3%)	0.15
Cardiac stent implantation	427 (63.5%)	318 (76.3%)	109 (42.7%)	< 0.001
Number of cardiac stents implanted	1.3 ± 0.6 1 [1–2]	1.3 ± 0.6 1 [1–2]	1.3 ± 0.5 1 [1–2]	0.78
Intra-aortic balloon pump	11 (1.6%)	8 (1.9%)	3 (1.2%)	0.55
PHARMACOTHERAPY IN HOSPITAL				
ASA	658 (97.9%)	413 (99%)	245 (96.1%)	0.009
Antiplatelet agents other than ASA	598 (89%)	399 (95.7%)	199 (78%)	< 0.001
GP IIb/IIIa inhibitors	406 (60.4%)	296 (71%)	110 (43.1%)	< 0.001
UFH/LMWH	660 (98.2%)	416 (99.8%)	244 (95.7%)	< 0.001
ACE inhibitor	604 (89.9%)	383 (91.8%)	221 (86.7%)	0.031
β-adrenolytics	621 (92.4%)	393 (94.2%)	228 (89.4%)	0.022
Statins	592 (88.1%)	371 (89%)	221 (86.7%)	0.37
ADVERSE EVENTS DURING HOSPITALISATION				
Re-infarction	9 (1.3%)	5 (1.2%)	4 (1.6%)	0.74
SCA	26 (3.9%)	22 (5.3%)	4 (1.6%)	0.016
Recurrent angina pectoris with ECG changes	29 (4.3%)	10 (2.4%)	19 (7.5%)	0.002
Recurrent angina pectoris without ECG changes	43 (6.4%)	17 (4.1%)	26 (10.2%)	0.002
Stroke	1 (0.1%)	0 (0%)	1 (0.4%)	0.385
Ventricular arrhythmias	20 (3%)	16 (3.8%)	4 (1.6%)	0.09
Supraventricular arrhythmias	45 (6.7%)	34 (8.2%)	11 (4.3%)	0.053
Pulmonary oedema	6 (0.9%)	3 (0.7%)	3 (1.2%)	0.68
Cardiogenic shock	12 (1.8%)	8 (1.9%)	4 (1.6%)	1
Significant bleeding	26 (3.9%)	20 (4.8%)	6 (2.4%)	0.11
HOSPITALISATION				
Time [days]	10.9 ± 6.6 10 [7–13]	11.2 ± 6.5 10 [7–13]	10.4 ± 6.7 9 [7–12]	0.011
Discharged home	601 (89.4%)	385 (92.3%)	216 (84.7%)	0.002
CABG referral	56 (8.3%)	20 (4.8%)	36 (14.1%)	< 0.001
PHARMACOTHERAPY AT HOSPITAL DISCHARGE				
ASA	586 (87.2%)	384 (92.1%)	202 (79.2%)	< 0.001
Other than ASA antiplatelets	483 (71.9%)	345 (82.7%)	138 (54.1%)	< 0.001
Anticoagulants	42 (6.3%)	21 (5%)	21 (8.2%)	0.096
ACE inhibitors	601 (89.4%)	377 (90.4%)	224 (87.8%)	0.29
Statins	623 (92.7%)	390 (93.5%)	233 (91.4%)	0.30
β-adrenolytics	619 (92.1%)	396 (95%)	223 (87.5%)	0.0005

Continuous and ordinal variables are shown as median [interquartile range] and as mean ± standard deviation, and others as number (percentage). ACE — angiotensin-converting enzyme; ASA — acetylsalicylic acid; CABG — coronary artery bypass grafting; COPD — chronic obstructive pulmonary disease; CRP — C reactive protein; DBP — diastolic blood pressure; ECG — electrocardiography; eGFR — estimated glomerular filtration rate; GP — glycoprotein; HDL — high-density lipoprotein; HR — heart rate; LAD — left anterior descending artery; LBBB — left bundle branch block; LCx — left circumflex artery; LDL — low-density lipoprotein; LM — left main coronary artery; LMWH — low-molecular-weight heparin; MI — myocardial infarction; MV-CAD — multivessel coronary artery disease; NA — non applicable; NYHA — New York Heart Association; PCI — percutaneous coronary intervention; POBA — plain old balloon angioplasty; PAD — peripheral artery disease; RBBB — right bundle branch block; RCA — right coronary artery; SCA — sudden cardiac arrest; SBP — systolic blood pressure; STEMI — ST-segment elevation myocardial infarction; TIMI — thrombolysis in myocardial infarction; UA/NSTEMI — unstable angina/non-ST-segment elevation myocardial infarction; UFH — unfractionated heparin

Table 2. Overall survival time following hospital discharge in ST-segment elevation myocardial infarction (STEMI) and unstable angina/non-ST-segment elevation myocardial infarction (UA/NSTEMI) groups

	All	STEMI	UA/NSTEMI	P
Survival time following hospital discharge [days]	2210 ± 671 2443 [2148–2613]	2220 ± 616 2435 [2135–2590]	2192 ± 753 2471 [2196–2645]	0.074

Continuous and ordinal variables are shown as median [interquartile range] and as mean.

Table 3. Comparison of survival of patients with ST-segment elevation myocardial infarction (STEMI) and unstable angina/non-ST-segment elevation myocardial infarction (UA/NSTEMI) in subsequent follow-up periods following hospital discharge

Post-discharge time	All (n = 672)	STEMI (n = 417)	UA/NSTEMI (n = 255)	p
30 days	7 (1%)	2 (0.5%)	5 (2%)	0.11
6 months	23 (3.4%)	9 (2.2%)	14 (5.5%)	**0.021**
1 year	31 (4.6%)	13 (3.1%)	18 (7.1%)	**0.018**
2 years	52 (7.7%)	26 (6.2%)	26 (10.2%)	0.062
3 years	67 (10%)	36 (8.6%)	31 (12.2%)	0.14
4 years	81 (12.1%)	46 (11%)	35 (13.7%)	0.30
5 years	99 (14.7%)	58 (13.9%)	41 (16.1%)	0.44
6 years	109 (16.2%)	66 (15.8%)	43 (16.9%)	0.72
7 years	122 (18.2%)	75 (18%)	47 (18.4%)	0.88
End of follow-up	123 (18.3%)	75 (18%)	48 (18.8%)	0.78

Data are shown as number (percentage).

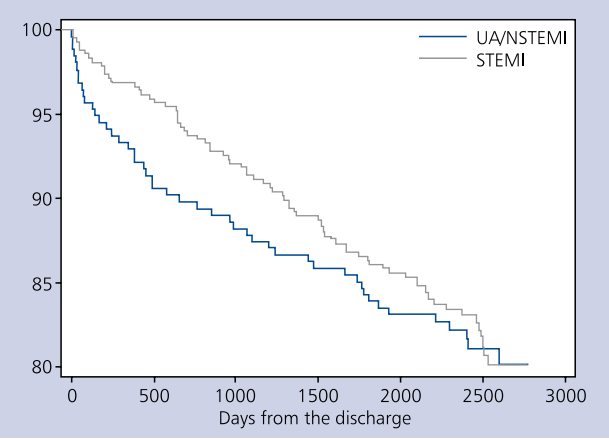

Figure 2. Kaplan-Meier survival analysis showing no significant difference between STEMI and UA/NSTEMI groups. Abbreviations — see Figure 1.

While the two-year survival in patients treated invasively was similar in both NSTEMI and STEMI (approximately 90%), the mortality rate in NSTEMI patients treated conservatively was 70% and in STEMI it was 60%. In the second-phase of study, in-hospital mortality was 0.8% in UA, 4.9% in NSTEMI, and 5.9% in STEMI patients, and depending on the treatment strategy: 1.1% in the invasively treated group compared to 0.6% in the non-invasively treated group in UA ($p = 0.017$), 8.1% vs. 2.1% in NSTEMI ($p < 0.001$), and 11.8% vs. 4.2% in STEMI ($p < 0.001$). Myocardial infarction incidence rates for UA, NSTEMI, and STEMI were 0.3%, 0.5%, and 0.6%, respectively, and stroke incidence rates were 0.1%, 0.4%, and 0.4%, respectively.

Despite a significantly worse prognosis of patients with STEMI than those with UA/NSTEMI in the early follow-up period, after two years of observation the prognosis began to level off, achieving comparable values in both groups at the end of follow-up (18% in the STEMI group and 18.8% in the UA/NSTEMI group). Similar results are presented in the studies of Savonitto et al. [15] and Volmink et al. [16]. Hospital mortality was higher in patients with STEMI than among those with NSTEMI (7% vs. 5%, respectively), but at six months the mortality rates were very similar in both conditions (12% vs. 13%, respectively).

Current guidelines for ACS focus mainly on management during in-hospital phase 1–3, and evidence supports the impact of therapies on the decline in acute complications of ACS. However, in the GRACE long-term study, despite high rates of guideline-indicated therapies, the late consequences of presentation with ACS, in terms of death, MI, and stroke, were substantially greater than those seen during the initial in-hospital phase. There were 736 (19.8%) deaths, 347 (9.3%) MIs, 261 (7.7%) strokes, and 452 (17%) subsequent revascu-

larisations. There were almost five-fold more deaths during follow-up than in the initial in-hospital admission with ACS (607 vs. 129). Readmission to hospital for suspected ACS was common. A total of 53.6% patients were readmitted, at least once, between discharge from the initial hospitalisation and five-year follow-up, 31.2% of patients had two or more admissions, and 9.2% had five or more admissions. On average, each patient with an original ACS event had 1.6 subsequent admissions for suspected ACS. Those findings highlight the importance of pursuing novel approaches to diminish long-term risk [10].

The Nationwide Inpatient Sample database was used to prepare one of the largest studies of post-ACS survival. The database contained 1,352,574 patients > 40 years of age, who had a diagnosis of STEMI between 1988 and 2004. The mean age for these patients was 66.06 ± 13.69 years. The incidence of STEMI was stable from 1988 to 1996, with a steady linear decrease to 1/2 by 2004. This decrease was similar across various races and genders [17].

Changing trends in the long-term prognosis and treatment of patients with ACS can be seen in the Register of Information and Knowledge about Swedish Heart Intensive Care Admissions (RIKS-HIA) conducted between 1996 and 2007. Registry-supported implementation of new treatment strategies in ACS have contributed to more than halving of 30-day mortality and providing around 1.7 (NSTEMI) — 2.6 (STEMI) years gained in the expected long-term life span for patients with ACS. During the 12-year period 92,205 patients with NSTEMI and 61,237 with STEMI were enrolled in the registry. In the NSTEMI population there was, from 1996 to 2007, an increase in median age from 72 to 73 years, in the proportion women from 34% to 38%, in hypertension from 34% to 47%, and in smoking from 19% to 21%, but a decrease in the proportion of patients with previous MI from 32% to 20%. Among the evidence-based treatments known to influence outcomes, in-hospital use of heparin/low-molecular-weight heparin was increasing from 36% to 85% and in-hospital start of aspirin from 85% to 91%, clopidogrel from 0% to 65%, β-blockers from 77% to 88%, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers (ACEI/ARB) from 33% to 62%, and statins from 23% to 78%. During the 12-year period, the risk factor adjusted 30-day and one-year mortality decreased from, respectively, 11.7% to 5.1% and 21.9% to 12.9%. In the STEMI population there was, over the same period, a decrease in median age from 71 to 69 years, an unchanged proportion of women (34%), an increase in hypertension from 29% to 39% and smoking from 26% to 30%, but a decrease in the proportion of patients with previous MI from 18% to 10%. From evidence-based treatments known to influence outcomes, reperfusion treatment increased from 67% to 78%, primary PCI from 4% to 65%, in-hospital use of low-molecular-weight heparins from 10% to 40% and in-hospital start of aspirin from 84% to 94%, clopidogrel from 0% to 84%, β-blockers from 81% to 90%, ACEI/ARB from 41% to 71%, and statins from 23% to 87%. During the 12-year period, the risk factor-adjusted 30-day and one-year mortality decreased from 12.9% to 6.3% and from 19.0% to 11.2%, respectively [18].

Finally, it is worth noting that the UA/NSTEMI group was treated and prescribed at discharge antiplatelets and β-blockers less frequently than the STEMI group, which could contribute to the higher risk of death in the first months after discharge in the UA/NSTEMI group. These results are in line with other studies. In a Swedish registry of patients with STEMI, between 1996 and 2007, there was an increase in the prevalence of evidence-based treatments. The use of aspirin, clopidogrel, β-blockers, statins, and ACEI all increased. During this same time, there was a decrease in 30-day and one-year mortality, which was sustained during long-term follow-up [19]. Moreover, a meta-analysis of trials comprising 19,302 patients with acute MI found that antiplatelet therapy — primarily with aspirin — resulted in an approximately 25% reduction in serious vascular events with a low risk of bleeding complications [20].

The data obtained from the PESEL database did not provide an opportunity to analyse the causes of death. It was also impossible to provide data on the occurrence of non-fatal complications. The smaller number of patients with UA/NSTEMI is also a limitation for statistical analysis. On the other hand, regarding the purpose of the study, data for the whole population seem to be largely useful and universal. Another limitation is the lack of division of the ACS group without persistent ST-segment elevation in UA and NSTEMI subgroups. It is well known that the UA subgroup has a better prognosis [10]. However, given the common definition of these populations in the standards for the diagnosis and treatment of ACS, and the fact that the UA group is a minority, especially in reference centres to which patients are referred for interventional treatment, the common denotation of these populations is, in our opinion, useful in practice. It should also be noted that the distinction between UA and NSTEMI patients would be difficult due to the data collection period, especially between 2002 and 2003 when new division of ACS was introduced into practice.

In conclusion, our study showed that the long-term (several years) prognosis is serious and survival does not depend on the type of ACS. Mortality risk steadily increases after hospital discharge. Despite a significantly worse prognosis of patients with UA/NSTEMI in the early follow-up period, overall prognosis in both subgroups (STEMI and UA/NSTEMI) was comparable.

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References

1. Karwowski J, Poloński L, Gierlotka M, et al. Post-procedural TIMI flow grade 2 is not associated with improved prognosis in patients with non-ST-segment elevation myocardial infarction undergoing percutaneous coronary revascularization (PL-ACS registry). Cardiol J. 2016; 23(4): 402–410, doi:10.5603/CJ.a2016.0025, indexed in Pubmed: 27296160.
2. Siudak Z, Pers M, Dusza K, et al. The efficacy of an education-based secondary outpatient prevention programme after acute coronary syndrome hospitalisations and treatment in Poland. The Patient Club initiative. Kardiol Pol. 2016; 74(2): 185–191, doi: 10.5603/KP.a2015.0225, indexed in Pubmed: 26596897.
3. Sanchis-Gomar F, Perez-Quilis C, Leischik R, et al. Epidemiology of coronary heart disease and acute coronary syndrome. Ann Transl Med. 2016; 4(13): 256, doi: 10.21037/atm.2016.06.33, indexed in Pubmed: 27500157.
4. Vedanthan R, Seligman B, Fuster V. Global perspective on acute coronary syndrome: a burden on the young and poor. Circ Res. 2014; 114(12): 1959–1975, doi: 10.1161/CIRCRESAHA.114.302782, indexed in Pubmed: 24902978.
5. Gierlotka M, Zdrojewski T, Wojtyniak B, et al. Incidence, treatment, in-hospital mortality and one-year outcomes of acute myocardial infarction in Poland in 2009-2012--nationwide AMI-PL database. Kardiol Pol. 2015; 73(3): 142–158, doi: 10.5603/KP.a2014.0213, indexed in Pubmed: 25371307.
6. Tunstall-Pedoe H, Kuulasmaa K, Mähönen M, et al. Contribution of trends in survival and coronary-event rates to changes in coronary heart disease mortality: 10-year results from 37 WHO MONICA project populations. Monitoring trends and determinants in cardiovascular disease. Lancet. 1999; 353(9164): 1547–1557, indexed in Pubmed: 10334252.
7. Goldberg RJ, Glatfelter K, Burbank-Schmidt E, et al. Trends in community mortality due to coronary heart disease. Am Heart J. 2006; 151(2): 501–507, doi: 10.1016/j.ahj.2005.04.024, indexed in Pubmed: 16442921.
8. Armstrong PW, Granger CB, Adams PX, et al. APEX AMI Investigators. Pexelizumab for acute ST-elevation myocardial infarction in patients undergoing primary percutaneous coronary intervention: a randomized controlled trial. JAMA. 2007; 297(1): 43–51, doi: 10.1001/jama.297.1.43, indexed in Pubmed:17200474.
9. Assessment of the Safety and Efficacy of a New Treatment Strategy with Percutaneous Coronary Intervention (ASSENT-4 PCI) investigators. Primary versus tenecteplase-facilitated percutaneous coronary intervention in patients with ST-segment elevation acute myocardial infarction (ASSENT-4 PCI): randomised trial. Lancet. 2006; 367(9510): 569–578, doi: 10.1016/S0140-6736(06)68147-6, indexed in Pubmed: 16488800.
10. Fox KAA, Dabbous OH, Goldberg RJ, et al. Prediction of risk of death and myocardial infarction in the six months after presentation with acute coronary syndrome: prospective multinational observational study (GRACE). BMJ. 2006; 333(7578): 1091, doi: 10.1136/bmj.38985.646481.55, indexed in Pubmed: 17032691.
11. Fox KAA, Carruthers KF, Dunbar DR, et al. Underestimated and under-recognized: the late consequences of acute coronary syndrome (GRACE UK-Belgian Study). Eur Heart J. 2010; 31(22): 2755–2764, doi: 10.1093/eurheartj/ehq326, indexed in Pubmed: 20805110.
12. Poloński L, Gasior M, Gierlotka M, et al. Polish Registry of Acute Coronary Syndromes (PL-ACS). Characteristics, treatments and outcomes of patients with acute coronary syndromes in Poland. Kardiol Pol. 2007; 65(8): 861–872; discussion 873, indexed in Pubmed: 17853315.
13. Tomaszuk-Kazberuk A, Kożuch M, Małyszko J, et al. Do overweight patients have a better five years prognosis after an acute myocardial infarction treated with coronary intervention? Kardiol Pol. 2012; 70(7): 686–693, indexed in Pubmed: 22825942.
14. Poloński L, Gasior M, Gierlotka M, et al. Polish Registry of Acute Coronary Syndromes (PL-ACS). Characteristics, treatments and outcomes of patients with acute coronary syndromes in Poland. Kardiol Pol. 2007; 65(8): 861–872; discussion 873, indexed in Pubmed: 17853315.
15. Savonitto S, Granger CB, Ardissino D, et al. GUSTO-IIb Investigators. Prognostic value of the admission electrocardiogram in acute coronary syndromes. JAMA. 1999; 281(8): 707–713, doi: 10.1001/jama.281.8.707, indexed in Pubmed: 10052440.
16. Volmink JA, Newton JN, Hicks NR, et al. Coronary event and case fatality rates in an English population: results of the Oxford myocardial infarction incidence study. The Oxford Myocardial Infarction Incidence Study Group. Heart. 1998; 80(1): 40–44, doi: 10.1136/hrt.80.1.40, indexed in Pubmed:9764057.
17. Movahed MR, John J, Hashemzadeh M, et al. Trends in the age adjusted mortality from acute ST segment elevation myocardial infarction in the United States (1988-2004) based on race, gender, infarct location and comorbidities. Am J Cardiol. 2009; 104(8): 1030–1034, doi:10.1016/j.amjcard.2009.05.051, indexed in Pubmed: 19801019.
18. Wallentin L, Svennblad B, Lindbäck J, Jernberg T. RIKS HIA: Survival benefits by 12 years registry supported improvement of acute cardiac care in the Sweden — the RIKS-HIA 12 years study. ESC Congress 2010. 30 Aug 2010.
19. Jernberg T, Johanson P, Held C, et al. SWEDEHEART/RIKS-HIA. Association between adoption of evidence-based treatment and survival for patients with ST-elevation myocardial infarction. JAMA. 2011; 305(16): 1677–1684, doi: 10.1001/jama.2011.522, indexed in Pubmed: 21521849.
20. Antithrombotic Trialists' Collaboration. Collaborative meta-analysis of randomised trials of antiplatelet therapy for prevention of death, myocardial infarction, and stroke in high risk patients. BMJ. 2002; 324(7329): 71–86, doi: 10.1136/bmj.324.7329.71, indexed in Pubmed: 11786451.

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