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CLINICAL RESEARCH
Acute Coronary Syndrome

Cardiovascular risk in post-myocardial infarction patients: nationwide real world data demonstrate the importance of a long-term perspective

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Aims Long-term disease progression following myocardial infarction (MI) is not well understood. We examined the risk of subsequent cardiovascular events in patients discharged after MI in Sweden.

Methods and results This was a retrospective, cohort study linking morbidity, mortality, and medication data from Swedish national registries. Of 108 315 patients admitted to hospital with a primary MI between 1 July 2006 and 30 June 2011 (index MI), 97 254 (89.8%) were alive 1 week after discharge and included in this study. The primary composite endpoint of risk for non-fatal MI, non-fatal stroke, or cardiovascular death was estimated for the first 365 days post-index MI and Day 366 to study completion. Risk and risk factors were assessed by Kaplan–Meier analysis and Cox proportional hazards modelling, respectively. Composite endpoint risk was 18.3% during the first 365 days post-index MI. Age [60–69 vs. <60 years: HR (95% CI): 1.37 (1.30–1.45); 70–79 vs. <60 years: 2.13 (2.03–2.24); >80 vs. <60 years: 3.96 (3.78–4.15)], prior MI [1.44 (1.40–1.49)], stroke [1.49 (1.44–1.54)], diabetes [1.37 (1.34–1.40)], heart failure [1.57 (1.53–1.62)] and no index MI revascularisation [1.88 (1.83–1.93)] were each independently associated with a higher risk of ischaemic events or death. For patients without a combined endpoint event during the first 365 days, composite endpoint risk was 20.0% in the following 36 months.

Conclusions Risk of cardiovascular events appeared high beyond the first year post-MI, indicating a need for prolonged surveillance, particularly in patients with additional risk factors.

Keywords Nationwide register data • Myocardial infarction • Risk factors • Prognosis • Mortality

Clinical perspective

This large-scale national Swedish registry study showed that 18.3% of patients with MI had a recurrent MI, stroke, or cardiovascular death in the first 365 days after the index event. The risk of a subsequent cardiovascular event (stroke, MI, or cardiovascular death) after MI was independently associated with age, medical history (diabetes, prior MI, stroke, unstable angina, or heart failure), and the use of revascularisation for the index event, in all patients with acute MI. The patients who remained stable for the first 365 days after MI were still at high risk; one of five patients experienced an event during the subsequent years.

Introduction

Coronary artery disease (CAD) is the leading cause of death worldwide.[1] In Europe alone, CAD is the underlying cause in 20% of all deaths.[2] While there is a trend towards declining mortality from CAD in developed countries,[2–4] estimated population growth and ageing offset the benefits achieved by improved treatments and reductions in risk factors, and suggest that a sustained and high global CAD mortality rate could be evident by 2030.[1] Therefore, the considerable morbidity and socioeconomic

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burden of CAD will continue to have a major impact over the coming decades.[2]

Improved survival among patients with myocardial infarction (MI) may lead to an increased awareness of the population with stable post-MI CAD, i.e. those without any further events shortly after an MI. In Nordic countries, these potentially high-risk patients are normally managed in a primary care setting, often after initial in-hospital treatment. Long-term specialist follow-up care is not commonly provided for this growing patient population. To our knowledge, data describing the stable post-MI population is scarce and limited to selected groups from clinical trials. The TRA-2P trial included patients in a less stable phase since patients were included recently after index event (2 weeks–6 months), and the CHARISMA trial included only a small number of stable post-MI patients.[5,6] The ongoing PEGASUS TIMI 54 trial is studying the effect of long-term dual anti-platelet treatment in a broad stable post-MI patient population consistent with a subset of patients studied herein.[7] Moreover, the contribution of individual risk factors in stable post-MI patients and in MI patients has not previously been compared.

The aim of this study was to examine the long-term risk of subsequent cardiovascular events in all patients hospitalized with MI and in those without any further events during the first year, from a nationwide perspective. Furthermore, the effect of conventional cardiovascular disease (CVD) risk factors and risk development in patient populations with different risk profiles was assessed.

Patients and methods

This observational, retrospective cohort study analysed data from mandatory Swedish national registries: the National Inpatient Register (IPR) [inpatient admission and discharge dates, and main and secondary diagnoses according to International Classification of Diseases, 10th revision, Clinical Modification (ICD-10-CM codes); (Supplementary Material online), the Swedish Prescribed Drug Register (all drugs dispensed in Sweden; from 1 July 2005); and the Cause of Death Register (complete nationwide coverage of date and cause(s) of death). The National IPR covers >99% of all somatic (including surgery) and psychiatric hospital discharges.[8] A validation of the IPR, where MI diagnoses recorded in patient journals were compared with IPR data, revealed that >95% of all MI diagnoses in the IPR are valid.[9] All drugs were classified according to the Anatomical Therapeutic Chemical classification system.[10] Individual patient-level data from these registers were linked via the unique personal identification number, which was then replaced by a study identification number prior to further data processing. The study protocol was reviewed and approved by the regional ethics committee in Linköping, Sweden (Reference number 013/294-31), and registered at ClinicalTrials.gov (clinical trial identifier NCT01984307). The linkage of data was approved and performed by the Swedish National Board of Health and Welfare. The linked database was managed by the Department of Cardiology and Department of Medical and Health Sciences, Linköping University, Linköping, Sweden.

Study populations

All patients who were admitted to hospital with a primary diagnosis (not secondary) of acute MI between 1 July 2006 and 30 June 2011 were eligible for this study. The MI population included male and female patients who were discharged with a diagnosis of acute MI (ICD-10: I21) and alive 1 week after discharge. The index MI was defined as the first recorded primary diagnosis of MI during the specified time period (not necessarily the patient's first MI). Patients who were alive and did not experience a recurrent MI or stroke during the first 365 days post-index MI were defined as the stable post-MI population. Follow-up data were collected from the time of the index MI until 31 December 2012, or death. Patient characteristics at baseline were established using hospitalization data from national registers from 1987 onwards.

Myocardial infarction population

Patients who died within 7 days of discharge following the index MI were excluded. Diagnoses and procedures conducted prior to the index MI (see Supplementary Material online data for definition of diagnoses and procedures), during the hospital stay and within 30 days following discharge were included in the baseline data after the index MI. The baseline medication catchment period was defined as medications dispensed 1 year prior to index MI date and within 30 days after discharge.

Stable post-myocardial infarction population

For patients who were alive and had not experienced a recurrent MI or stroke during the 365 days after the index MI, the baseline date was defined as the index MI date plus 365 days. Baseline characteristics for

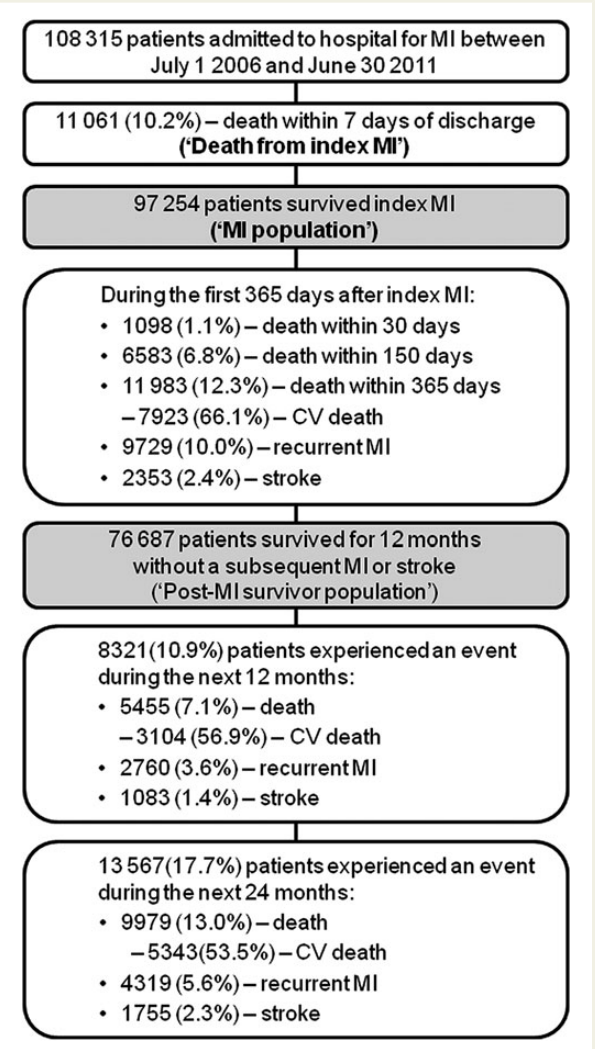

Figure 1 Flow chart.

Table 1 Baseline demographic and clinical characteristics for the myocardial infarction population at hospital discharge after index myocardial infarction, and for the stable post-myocardial infarction population who survived for 12 months without a subsequent myocardial infarction or stroke

	At discharge after index MI (n = 97 254)	Stable post-MI[a] (n = 76 687)
Age (years)		
Mean (SD)	72.4 (12.7)	71.5 (12.5)
Median (range)	74 (19–106)	72 (20–105)
<50 years, *n* (%)	4608 (4.7)	3663 (4.8)
50–64 years, *n* (%)	22 562 (23.2)	19 338 (25.2)
65–74 years, *n* (%)	23 172 (23.8%)	20 085 (26.2%)
75–84 years, *n* (%)	28 148 (28.9%)	20 915 (27.2%)
≥85 years, *n* (%)	18 759 (19.3%)	12 686 (16.5%)
Gender, *n* (%)		
Male	59 887 (61.6)	48 543 (63.3)
Female	37 367 (38.4)	28 144 (36.7)
Heart failure, *n* (%)	25 570 (26.3)	20 230 (26.4)
Previous MI, *n* (%)	10 083 (10.4)	6436 (8.4)
Previous unstable angina pectoris, *n* (%)	4852 (5.0)	3504 (4.6)
Peripheral arterial disease, *n* (%)	6037 (6.2)	4885 (6.4)
Invasively treated, *n* (%)[b]	46 813 (48.1)	42 141 (55.0)
PCI, *n* (%)[b]	41 678 (42.9)	37 497 (48.9)
CABG, *n* (%)[b]	6039 (6.2)	5438 (7.1)
Stroke total, *n* (%)	10 475 (10.8)	7351 (9.6)
Non-ischaemic stroke, *n* (%)	866 (0.9)	633 (0.8)
Ischaemic stroke, *n* (%)	9885 (10.2)	6909 (9.0)
Atrial fibrillation, *n* (%)	18 611 (19.1)	14 487 (18.9)
Chronic renal dysfunction, *n* (%)	1198 (1.2)	983 (1.3)
Diabetes mellitus, *n* (%)	22 589 (23.2)	17 712 (23.1)
Major bleeding, *n* (%)	5772 (5.9)	4966 (6.5)
Moderate and severe liver disease, *n* (%)	429 (0.4)	386 (0.5)
Bleeding diathesis/coagulation disease, *n* (%)	949 (1.0)	829 (1.1)
Cancer, *n* (%)	12 458 (12.8)	10 071 (13.1)
Type of hospital (index event)		
Cardiology department at a university hospital, *n* (%)	22 565 (23.2)	–
Cardiology department (with in-patient function) at a regional hospital, *n* (%)	9043 (9.3)	–
All other hospital departments, *n* (%)	65 646 (67.5)	–
Ongoing medications at discharge after index MI at Day 366 after index MI		
ACEI, *n* (%)	58 341 (60.0)	37 500 (48.9)
ARB, *n* (%)	17 671 (18.2)	20 015 (26.1)
Aspirin, *n* (%)	88 883 (91.4)	63 166 (82.4)
Clopidogrel, *n* (%)	66 724 (68.6)	19 294 (25.2)
β-Blocker, *n* (%)	86 115 (88.5)	61 114 (79.8)
Calcium-channel blocker, *n* (%)	26 933 (27.7)	15 473 (20.2)
Insulin, *n* (%)	10 758 (11.1)	6926 (9.0)
Oral anti-diabetic, *n* (%)	13 325 (13.7)	8652 (11.3)
Proton pump inhibitor, *n* (%)	31 373 (32.3)	19 036 (24.8)
Statin, *n* (%)	76 084 (78.2)	55 974 (73.0)
Warfarin/NOAC, *n* (%)	9038 (9.3)	5602 (7.3)
NSAIDs, *n* (%)	20 720 (21.3)	5544 (7.2)
SSRI, *n* (%)	10 430 (10.7)	7145 (9.3)

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; CABG, coronary artery bypass graft; MI, myocardial infarction; NSAID, non-steroidal anti-inflammatory drug; NOAC, new oral anti-coagulant; PCI, percutaneous coronary intervention; SD, standard deviation; SSRI, selective serotonin reuptake inhibitor.
[a]Baseline data at Day 366 after index MI.
[b]Performed for index MI.

this population included diagnoses and procedures conducted up to the date of stable post-MI. Medication use ongoing at the stable post-MI date was defined as medication dispensed 8–12 months after index MI.

High-risk stable post-myocardial infarction population

High-risk patients were predefined as patients with at least one of the following risk factors prior to index MI: diabetes mellitus, at least one MI prior to index MI event, coronary artery bypass graft surgery (CABG; proxy for multi-vessel CAD), peripheral arterial disease, stroke, heart failure, or diagnosis of chronic renal dysfunction.

Outcomes

The primary endpoint was a composite of non-fatal MI (ICD-10: I21), non-fatal stroke (ICD-10: I61–I64), or cardiovascular death (all primary causes of death diagnosed with ICD-10 codes I00–I99).

Statistical methods

Patient characteristics were analysed descriptively at the time of the index MI and at Day 366 for those patients alive without a composite endpoint after 365 days (stable post-MI population). The frequency and proportion of patients with the primary composite endpoint were assessed and a Kaplan–Meier analysis undertaken to estimate the cumulative probability of the primary composite endpoint during two distinct time periods: the first 365 days after index MI and from Day 366 to the end of study follow-up in the stable post-MI patients. A Cox proportional hazards model was used to analyse the importance of conventional (and available) pre-specified CVD risk factors in relation to the outcomes of interest (age, gender, prior MI, unstable angina pectoris, stroke, heart failure, diabetes, and revascularization status). Results were presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Patients defined as high risk were compared with patients defined as low risk; these analyses were stratified by the median age in the population (74 in the MI population and 72 in the stable post MI population). Patients without an event were censored at extraction date or non-cardiovascular death.

In order to test for the appropriateness of censoring at time for non-cardiovascular death, competing risk analyses were performed using the cmprsk package in R, where non-cardiovascular death was classified as a competing risk.

Results

Overall, 108 315 individuals were admitted to hospital for a primary MI during the study period, of whom 97 254 (90%) survived and were alive 1 week after hospital discharge. Seventy-one per cent of the study population (76 687 patients) survived 365 days without any subsequent MI or stroke (*Figure 1*). The study comprised a total of 278 110 patient-years of follow-up: 83 665 patient-years of follow-up in the MI population; and 194 445 patient-years in the stable post-MI population. The mean duration of follow-up time was 2.54 years in the stable post-MI population and the maximum follow-up time was 5.5 years.

In the MI population, ~50% of patients were 75 years or older and 62% were male (*Table 1*). Invasive treatment within 30 days from admission was received by 48.1% of the patients; 41 678 (42.9%)

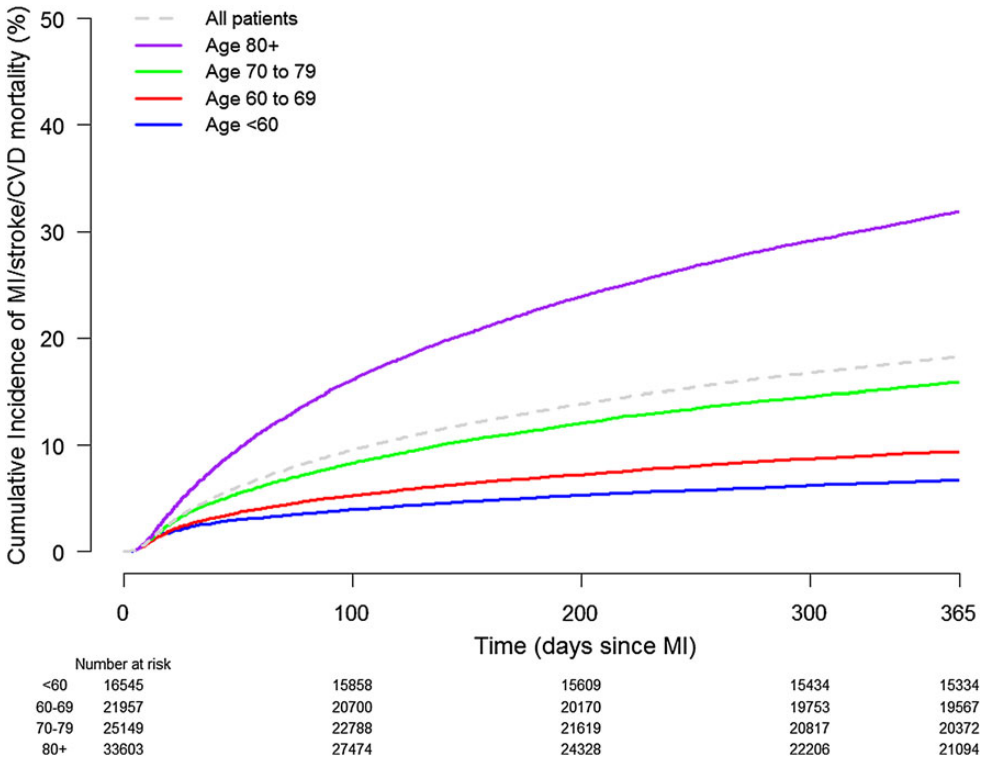

Figure 2 Kaplan–Meier estimate of the risk of the combined endpoint (myocardial infarction, ischaemic stroke, or cardiovascular death) during the first 365 days after the index myocardial infarction, stratified by age.

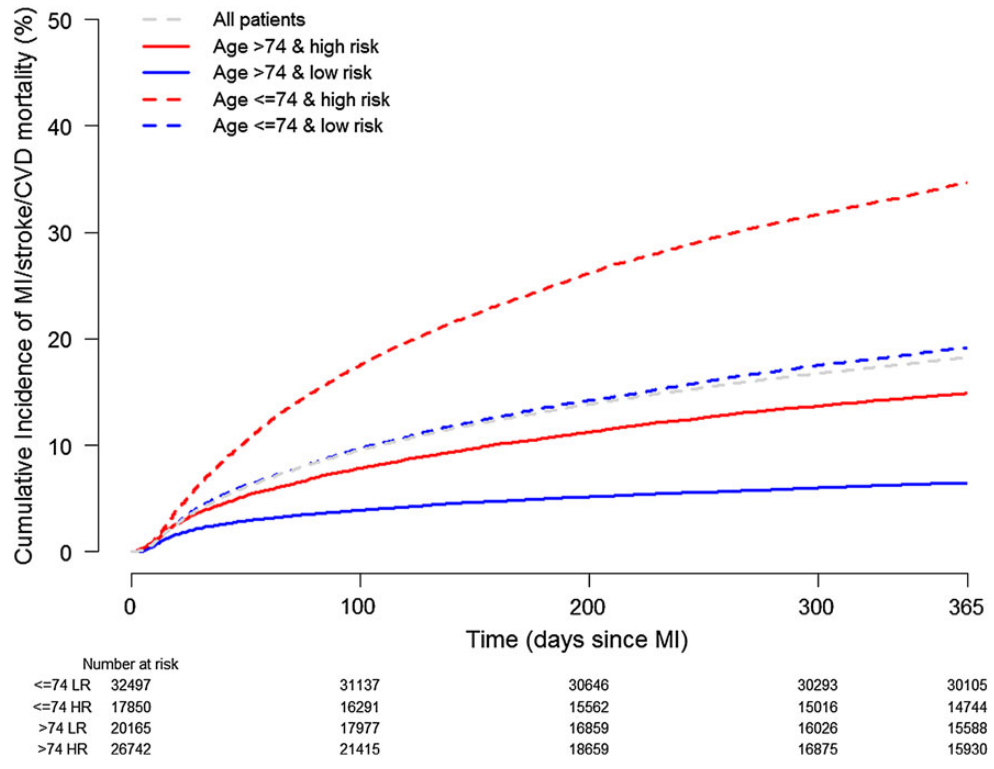

Figure 3 Kaplan–Meier estimate of the risk of the combined endpoint (myocardial infarction, ischaemic stroke, or cardiovascular death) during the first 365 days after the index myocardial infarction, stratified by age and high- vs. low-risk patients.

underwent percutaneous coronary intervention (PCI) and 6039 (6.2%) underwent CABG (*Table 1*) for the index MI.

The cumulative rate of the primary composite endpoint (MI, stroke, or cardiovascular death) was 13.3 and 18.3% during the first 6 and 12 months, respectively, in the MI population. Of the patients who experienced an event during the first 365 days, 55.5% experienced a recurrent non-fatal MI, 13.4% experienced a non-fatal stroke, and 31.0% died due to cardiovascular causes as their first event. In addition, 4060 (4.2%) patients died due to non-cardiovascular causes (first year follow-up).

The composite endpoint risk was 18.3% during the first 365 days post-index MI. The cumulative probability of the combined endpoint increased with age: 6.5% in patients aged <60, 14.9% in patients aged 60–69, 19.2% in patients aged 70–79 and 34.7% in patients aged ≥80 (*Figure 2*).

High-risk patients (defined by diagnosis of any of the following; diabetes mellitus, at least one MI prior to index MI, CABG, peripheral arterial disease, stroke, heart failure, or chronic renal dysfunction) had a substantially increased cumulative probability of experiencing a combined endpoint event compared with low-risk patients (*Figure 3*). Stratification of the data by age showed that the estimated risk for the younger high-risk patients (≤74 years) resembled that of the low-risk patients in the older age category (>74 years).

Compared with the MI population (*Table 1*), the stable post-MI patients (patients survived for 365 days after index MI without recurrent MI or stroke) were younger (median 72 vs. 74 years) and included a smaller proportion of patients aged ≥75 (43.9 vs. 51.5%). Stable post-MI patients had a lower co-morbidity rate at baseline relative to the MI population, including heart failure, MI prior to the index event, peripheral arterial disease, history of ischaemic stroke, atrial fibrillation, chronic renal dysfunction, and diabetes. Compared with the MI population, a higher proportion of stable post-MI patients received invasive treatment for the index MI (55.0 vs. 48.1%), and received guideline recommended therapies at discharge, including angiotensin-converting enzyme (ACE) inhibitors, aspirin, clopidogrel, β-blocker, and statins.

The cumulative probability of a subsequent event in the stable post-MI population was 9.0% after 12 and 20.0% after 36 months follow-up. Among these patients, 40.8% experienced an MI, 18.6% experienced stroke, and 40.6% died due to cardiovascular causes as their first event. In addition, there were a total of 4519 (5.9%) patients who died from non-cardiovascular causes. *Figure 4* shows the cumulative probability of the combined endpoint, stratified by age. The cumulative probability of the combined endpoint in stable post-MI patients following the post-index period (i.e. from years 1–4 after the index MI) increased with age: 11.2% in patients aged <60, 18.1% in patients aged 60–69, 30.1% in patients aged 70–79 and 59.1% in patients aged ≥80 at maximum follow-up of 5.4 years (*Figure 4*). High-risk patients had a substantially higher cumulative probability of the combined endpoint compared with the low-risk population (*Figure 5*).

The cumulative probabilities of the combined endpoint based on the competing risk analyses were essentially the same (see Supplementary Material online, Table S1–S4).

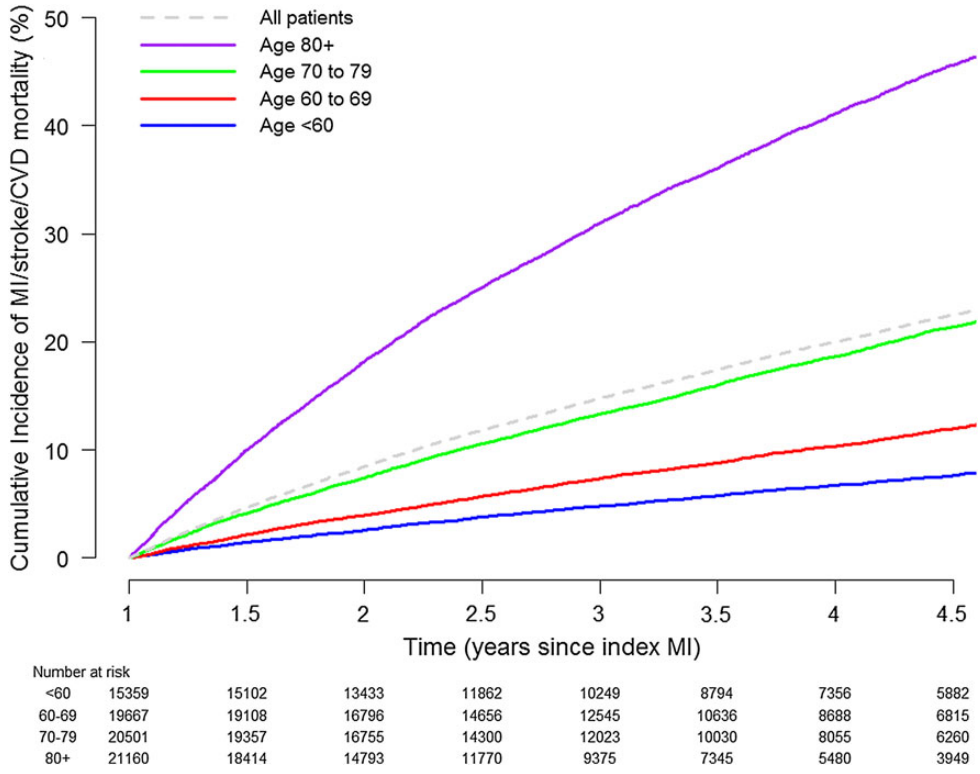

Figure 4 Kaplan–Meier estimate of the risk of the combined endpoint (myocardial infarction, ischaemic stroke, or cardiovascular death) after 365 days after index myocardial infarction until end of study for stable post-myocardial infarction patients, stratified by age.

The association between individual risk factors (older age, diabetes, no revascularisation for the index MI, and a prior history of MI, stroke, heart failure, or unstable angina) and risk of the combined endpoint were similar during the two follow-up periods, with the exception of prior unstable angina, which was predictive in the MI population but not the stable post-MI population (*Table 2*).

Discussion

The results from this study show that, in the Swedish population, one in five patients discharged with MI had a subsequent cardiovascular event (stroke, MI, or cardiovascular death) in the first 365 days after the index MI. Risk for cardiovascular events was strongly associated with age, medical history (diabetes, prior MI, stroke, unstable angina, or heart failure), and the use of revascularization for the index event. For patients surviving 1 year without a subsequent cardiovascular event after MI, the risk remained high, with one in five patients experiencing an event during subsequent years. Furthermore, the relative importance of conventional risk factors for an event did not differ markedly between the stable post-MI and the MI populations.

In recent years, the incidence of MI has declined in Western countries and 1-year post-MI survival rates have improved, leading to growth of the stable post-MI patient population.[2–4] The Swedish healthcare system is well recognized for having high 30-day survival rates in MI patients. For example, 30-day mortality in patients with acute coronary syndromes (ACS) was recently demonstrated to be lower in Sweden compared with the UK.[11] Therefore, in the coming decades, the stable post-MI population is likely to represent a greater proportion of patients with CAD.

Our dataset is uniquely placed to examine risk factors in the stable post-MI population in Sweden since it includes data from all patients hospitalized for MI across the whole country. Compared with other cardiovascular registers where patients are actively recruited,[12–16] there were no criteria for patient selection; thus, our patients were considerably older, and fewer underwent revascularization. Notably, a large proportion of our patients were receiving adequate drug treatment (with statins, β-blockers, ACE inhibitors, angiotensin receptor blocking [ARB] agents, and dual anti-platelet therapy with aspirin and clopidogrel), compared with patients in other cardiovascular registers[12–16] or with patients in a nationwide ACS patient population in Denmark.[17] The patients enrolled in the ongoing PEGASUS TIMI 54 trial are significantly younger and more underwent revascularization. Due to the inclusion criteria, more patients were diagnosed with diabetes, previous MI, and multi-vessel CAD. When taking age into consideration, the observed cardiovascular risk in our study was comparable with observations from randomized controlled clinical trials.[18] Notably, the overall risk was still high, especially in elderly patients and in patients with heart failure. Furthermore, patients who did not undergo revascularization had an elevated risk of future cardiovascular events compared with revascularized patients. This is in line with findings from other clinical studies[19–21]

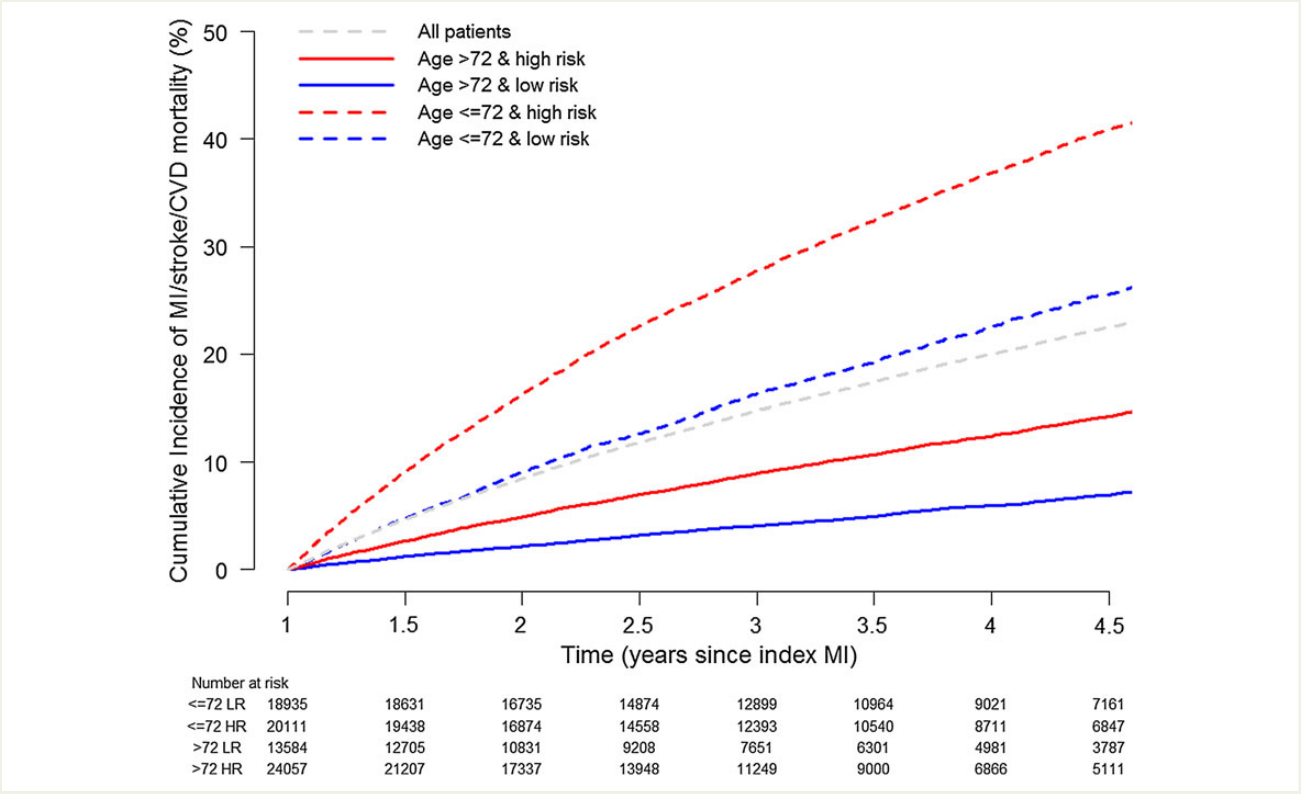

Figure 5 Kaplan–Meier estimate of the risk of the combined endpoint (myocardial infarction, ischaemic stroke, or cardiovascular death) after 365 days after index myocardial infarction until end of study for stable post- myocardial infarction patients, stratified by age and high- vs. low-risk patients.

Table 2 Cox multivariable proportional regression model[a] of risk factors for a combined endpoint event (myocardial infarction, stroke, or cardiovascular death)

Variable	First 365 days after index MI		Day 366 until end of study	
	HR (95% CI)	*P*-value	HR (95% CI)	*P*-value
Aged 60–69 vs. <60 years	1.37 (1.30–1.45)	<0.001	1.44 (1.34–1.56)	<0.001
Aged 70–79 vs. <60 years	2.13 (2.03–2.24)	<0.001	2.35 (2.19–2.52)	<0.001
Aged ≥80 vs. <60 years	3.96 (3.78–4.15)	<0.001	4.91 (4.58–5.25)	<0.001
Females vs. males	0.91 (0.89–0.93)	<0.001	0.88 (0.85–0.91)	<0.001
Prior MI	1.44 (1.40–1.49)	<0.001	1.31 (1.26–1.37)	<0.001
Prior stroke	1.49 (1.44–1.54)	<0.001	1.51 (1.44–1.59)	<0.001
Diabetes	1.37 (1.34–1.40)	<0.001	1.47 (1.42–1.52)	<0.001
Prior heart failure	1.57 (1.53–1.61)	<0.001	1.68 (1.62–1.74)	<0.001
Prior unstable angina	1.13 (1.08–1.17)	<0.001	1.00 (0.96–1.05)	<0.001
No revascularization vs. revascularization	1.88 (1.83–1.93)	<0.001	1.92 (1.84–1.99)	<0.001

CI, confidence interval; HR, hazard ratio; MI, myocardial infarction.
[a]Adjusted for age, gender, prior MI, prior stroke, diabetes, prior heart failure, prior unstable angina, and revascularization status.

but the magnitude of the association in this observational study is probably explained by a combination of confounding and a true treatment effect.

The stable post-MI population had a lower median age, higher degree of revascularization and contained a lower proportion of female patients, compared with the MI population. Since high-risk patients often experience events or die during the first year after an MI, it was not surprising that the stable post-MI patients were less likely to experience atrial fibrillation, heart failure, stroke, or diabetes compared with the MI population. During the first 365 days,

there was a reduction in the proportion of patients treated with different evidence-based medications. However, the majority of patients continued to receive statins, β-blockers, aspirin, and ACE inhibitor/ARB treatment. Twenty-five per cent of patients were treated with clopidogrel beyond 1 year following the index MI. This reduction in adherence to evidence-based treatment during follow-up has also been described by others.[22,23]

After 3 years of follow-up, the overall cardiovascular risk in the stable post-MI group resembled that of the MI population after 1 year of follow-up. Overall, 20% of patients experienced an event during the follow-up period after becoming stable post-MI patients; recurrent MI and cardiovascular death were the most frequent events. The same risk factors were associated with the risk of the combined endpoint in the stable post-MI population as in the MI population, although the relative risk contribution of age appeared to be more important in the stable post-MI patient population than in the MI patient population.

There is a scarcity of data describing cardiovascular risk in similar stable post-MI populations with which to compare our findings. The CLARIFY registry included data on patients with stable CAD and history of MI (~50% of the patient population) and reported a 1-year rate of cardiovascular death, non-fatal MI, or stroke of 1.8%; significantly lower than the 9% overall event rate in our population.[24] Potential reasons for this difference could be that the CLARIFY registry included patients diagnosed with CAD 5 years prior to the start of follow-up period and included a much younger population.

There is a wealth of evidence to suggest that cardiac rehabilitation programmes (CRPs) reduce mortality and the future risk of recurrent MI.[25] Furthermore, these programmes are highly recommended by the European Society of Cardiology and American Heart Association.[26,27] However, the majority of European patients with MI do not enter CRPs and the long-term management of these patients is often carried out by the patient's general practitioner.[28] Compared with other chronic disease patient populations where regular follow-up in specialist care is often combined with follow-up primary care,[29] the involvement of specialist care was less structured and less frequent for the stable post-MI patients. Our study indicated that a large proportion of these patients continued to be at high risk of cardiovascular events and often had a complex treatment regime for other CVDs (e.g. atrial fibrillation, heart failure, or diabetes). Thus, prolonged effective prevention programs and sustained contact with a cardiologist, parallel to contact with a general practitioner, may be warranted in this population.

The strengths of our study are that it was conducted in a large, national cohort of patients including all patients who were hospitalized for MI within Sweden.[8] This study design eliminated any potential problems that could arise from selection bias. The study also has limitations. As a database analysis, we were reliant on ICD-10 codes for morbidity data. Therefore, we cannot rule out the possibility of coding errors, although, previous data show that coding is correct in >98% of Swedish IPR entries[8] and that elsewhere in the world, the sensitivity and specificity rates of ICD-10 codes for MI exceed 93%,[30] ICD codes still lack specificity regarding important descriptors of the patient population, including presence or not of ST-segment elevation and whether the MI was of type 1 or type 2 (secondary MI). Another limitation of our study was the lack of available data on clinical risk factors, e.g. smoking, lipids, body weight, and blood pressure. Our study only included patients with a primary diagnosis of MI, and we cannot rule out that the risk development in patients with MI as a secondary diagnosis might be different. Furthermore, our results might also be affected by censoring death other than that related to CVD. However, the analysis of probability of event taking competing risk into account showed similar results as expected with a minor effect in the oldest patients. In this study, we did not have access to angiography data and CABG was used as a proxy for multi-vessel disease since most patients undergoing CABG have two or more vessels with stenoses.[31] However, a small proportion of these patients have complex 1 vessel disease not suitable for PCI, thus potentially overestimating the size of the multi-vessel disease population.

Conclusions

This large-scale national Swedish registry study showed that the risk of cardiovascular events remained high in the period following the first 365 days post-index MI, indicating that MI patients should be carefully monitored and managed with effective prevention programs beyond the first year, particularly in those considered to be at high-risk of subsequent ischaemic events.

Supplementary material

Supplementary material is available at *European Heart Journal* online.

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Conflict of interest: L.P.H. and M.H. are employed by AstraZeneca. M.T. is employed by an independent statistical consultant company, Statisticon, for which AZ is a client.

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