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Managed Care after Acute Myocardial Infarction (MC-AMI) – a Poland's nationwide program of comprehensive post-MI care - improves prognosis in 12-month follow-up. Preliminary experience from a single high-volume center☆

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ABSTRACT

Background: Despite progress in the treatment of acute myocardial infarction (AMI), long-term prognosis in MI survivors remains a challenge. The Managed Care in Acute Myocardial Infarction (MC-AMI, KOSzawal) is the first program of a comprehensive, supervised care for patients with AMI to improve long-term prognosis. It includes acute intervention, complex revascularization, cardiac rehabilitation (CR), outpatient follow-up, and prevention of SCD. Our aim was to assess the relation between participation in MC-AMI and major adverse cardiovascular and cerebrovascular events (MACCE) in 12-month follow-up.

Methods and results: In this single-center, retrospective analysis we compared 719 patients participating in MC-AMI and compared them to 1130 subjects in the control group. After propensity score matching, two groups of 529 subjects each were compared.

MC-AMI was related with MACCE reduction by 40% in a 12-month observation. Participants of MC-AMI had a higher adherence to cardiac rehabilitation (98 vs. 14%), higher rate of scheduled revascularisation (coronary artery bypass grafting: 9.8% vs. 4.9%, $p \ll 0.001$; elective percutaneous coronary intervention: 3.0% vs 2.1%, $p \ll 0.05$) and ICD implantation (2.8% vs. 0.6%, $p \ll 0.05$) compared to control.

Multivariable Cox regression analysis revealed MC-AMI to be inversely associated with the occurrence of MACCE (HR = 0.500, 95% CI 0.349–0.718, $p \ll 0.001$). Besides, older age, diabetes mellitus, hyperlipidemia, prior PAD, previous UA, and lower LVEF were significantly associated with the primary endpoint.

Conclusions: MC-AMI is the first program of comprehensive care for AMI patients. MC-AMI improves prognosis by increasing the rate of patients undergoing CR, complete revascularization and ICD implantation, thus reducing MACCE.

1. Introduction

Cardiovascular diseases (CVD) are a leading cause of mortality in Western societies. Despite advances in the medical and interventional treatment of the acute phase of myocardial infarction (MI), the post-MI complications, including heart failure and sudden cardiac death remain a challenge and the major concerns of clinical cardiology.

In Poland, the network of approximately 160 interventional cardiology centers provides primary percutaneous coronary intervention (pPCI) service on the 24/7 basis with 735 pPCI/million inhabitants, thus providing low in-hospital mortality in the acute phase of MI. The post-discharge mortality in AMI patients is, however, still high - 10% after 1 year and almost 20% after 3 years

☆ All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

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[1]. European Society of Cardiology (ESC) registries show that 1-year mortality rate reached 4–12% and is highly variable across Europe. This is similar to data reported from the USA, and European countries [2–4]. The studies suggest that efforts should focus on a post-MI care and the secondary prevention of CVD [5,6].

The analysis of the post-discharge period shows a particularly high risk of complications and death within the first several months after MI. The causes comprise the lack of adequate lifestyle intervention, poor adherence to medical treatment, insufficient control of risk factors and the lack of balanced physical activity, which derives mostly from low access to cardiac rehabilitation (CR) programs, as well as poor and imbalanced access to outpatient cardiology care [7,8]. Other factors include comorbidities, incomplete coronary revascularization and underutilization of implantable cardioverters-defibrillators (ICDs) in eligible post-MI patients for primary prevention of sudden cardiac death (SCD) [9–11]. Despite clear ESC recommendations for secondary CVD prevention, the real-world data show that there is still much to do with regard to post-MI care and the coordination of all the key parts of it [12,13].

Considering the complexity of determinants of high post-MI mortality rate, Polish Cardiac Society, National Health Fund and Ministry of Health of Poland have introduced the program of coordinated care for patients with MI [14]. The Managed post-AMI Care Program (MC-AMI; in Polish KOS-zawal) includes diagnostic procedures and interventional therapy in acute phase of MI, immediate or staged complete revascularization, cardiac rehabilitation, primary prevention of SCD with implantation of ICD or cardiac resynchronization therapy (CRT) in eligible subjects and, 12-month scheduled outpatient cardiology care follow-up [15]. Although these are all the parts of the regular state-of-the-art care for MI survivors, we hypothesize that strict follow-up and coordination of all crucial parts of post-MI care may significantly improve the prognosis without any additional intervention.

2. Objectives/aims

The primary aim of the analysis was to assess the relation between participation in MC-AMI and the incidence of major cardiovascular and cerebrovascular events (MACCE), defined as a composite of death, recurrent myocardial infarction, ischemic stroke, and hospitalization for heart failure (HF) in one-year follow-up.

The secondary aim was to compare the utilization of crucial post MI care components: revascularization, cardiac rehabilitation, outpatient care and the prevention of SCD in MC-AMI program vs. usual care (control group).

3. Patients and methods

We present a retrospective analysis from a single high-volume tertiary cardiology care center, where MC-AMI – a program of coordinated, supervised post MI care - was introduced. A study group consisted of all consecutive subjects diagnosed with AMI from November 1, 2017 to August 31, 2018 who consented to participate in MC-AMI. All patients with AMI, aged ≫18 years old who gave the informed consent for participation in MC-AMI, were included in the unmatched study group. Patients were followed up to November 30, 2018. The control group consisted of AMI patients who were hospitalized in our center within 1 year prior to the introduction of MC-AMI program. Data from all consecutive admissions with AMI diagnosis between November 1, 2016 and August 31, 2017 was used for analysis. These patients were followed up to November 30, 2017. Patients' enrolment scheme is presented in Fig. 3 (supplementary data).

The participation in MC-AMI ensured diagnostics and interventional therapy in AMI according to ESC guidelines (Module I), cardiac rehabilitation (outpatient or in-hospital) (Module II), implantation of ICD or CRT-D in eligible subjects (Module III), and 12-month scheduled, outpatient cardiology care and follow-up (Module IV).

The study flowchart is presented in Fig. 4 (supplementary data). After AMI-related hospitalization, patients who consented for participation in MC-AMI had a screening visit scheduled 7–10 days post discharge. The screening visit covered clinical assessment by cardiologist, ECG and basic blood tests (full blood count, CrCl, CRP). Unless contraindicated, patients were then qualified for cardiac rehabilitation (described below), which started not later than 14 days post-discharge. Upon CR completion, patients attended Visit 1 that was scheduled 6 weeks after discharge from hospital (MI-related hospitalization). During visit 1, clinical assessment and echocardiography was performed to search for patients eligible for implantation of ICD (implantable cardioverter defibrillator) or CRT (cardiac resynchronization therapy). Visit 2 was normally scheduled 2–3 months after CR completion or 4 weeks after ICD/CRT implantation. Visit 3 timing was planned at the discretion of physician. Visit 4 was performed at the end of 12-month FU.

Additionally, the course of MC-AMI schedule in particular patient could have been modified based on several factors, the most important being staged revascularization and indication for ICD/CRT-D.

For initial analysis, we recruited an overall number of 2341 patients with AMI [1211 (51.7%) patients were enrolled into study group and 1130 (48.3%) in control group]. In the study group, there were 69 (5.7%) in-hospital deaths. Out of remaining 1142 subjects, 719 (63%) consented for participation in MC-AMI. In the control group there were 67 in-hospital deaths (5.9%) and remaining 1063 patients were analyzed as an unmatched control group.

To reduce a selection bias we performed 1:1 propensity score matching (PSM) between the study and the control group using pre-specified clinical variables, including age, sex, hypertension, diabetes mellitus, dyslipidemia, smoking, chronic kidney disease, stroke, presentation as STEMI, presence of multivessel disease and left ventricular ejection fraction (LVEF).

MI was diagnosed in line with the Third Universal Definition of Myocardial Infarction. Coronary angiography was performed via either radial or femoral artery by a standard technique. The use of stent type was at the individual operator's discretion. Standard post-MI pharmacotherapy was used according to the European Society of Cardiology recommendations unless contraindicated. Medication at discharge is summarized in Table 1. Transthoracic echocardiography was performed to assess the left ventricular ejection fraction (LVEF) using the modified Simpson's biplanar method. Chronic kidney disease (CKD) was defined as an estimated glomerular filtration rate ≪60 ml/min/1,73 m2. Hospitalization for HF was defined as admission to a health care facility lasting ≫24 h due to worsening of symptoms of HF and followed by specific HF treatment (regardless of the cause of decompensation).

Cardiac rehabilitation was preceded by a screening visit (7–10 days after discharge) and performed in an outpatient cardiac rehabilitation facility (22 days) or in-hospital cardiac rehabilitation ward (hospitalization up to 35 consecutive days). The key criterion for in-hospital rehabilitation was EF ≤35%. Additionally, patients with serious comorbidities and frailty may have been qualified for in-hospital CR regardless of EF.

Follow-up ECG, TTE, 6-minute walk test (6MWT) and treadmill test were performed in all patients during cardiac rehabilitation. CR program included all core components recommended by European Society of Cardiology. At baseline ETT (exercise treadmill test) was performed to tailor CR program to patient's exercise capacity. Rehabilitation program included interval training on an ergometer,

Table 1
Baseline characteristics in unmatched study groups (n = 1782).

	Unmatched study group N = 719 Mean ± SD or median (1Q–3Q) or n (%)		Unmatched control group N = 1063 Mean ± SD or median (1Q–3Q) or n (%)		*p*-Value
Age [years]	**65.97 ± 10.55**	**66 (59; 77)**	**68.61 ± 11.27**	**68 (60; 76)**	**≪0.0001**[a]
LVEF [%]	**45.74 ± 10.64**	**48 (39; 55)**	**44.01 ± 11.57**	**48 (36; 55)**	**0.001**[a]
Female sex	220 (30.6%)		361 (33.9%)		0.146[b]
History of CHD	351 (48.9%)		519 (48.9%)		0.995[b]
Arterial hypertension	**564 (78.6%)**		**881(82.8%)**		**0.030**[b]
Diabetes mellitus	227 (31.6%)		338 (31.8%)		0.925[b]
Hyperlipidemia	**490 (68.2%)**		**792 (74.4%)**		**0.001**[b]
Previous stroke	**41 (5.7%)**		**96 (9.0%)**		**0.010**[b]
CKD	**120 (16.7%)**		**26.6 (26.6%)**		**0.001**[b]
Smoking	293 (40.8%)		479 (451%)		0.087[b]
Previous STEMI	97 (13.5%)		165 (5.5%)		0.246[b]
Previous NSTEMI	116 (16.2%)		179 (16.8%)		0.707[b]
Previous PCI	219 (30.5%)		310 (29.1%)		0.555[b]
Previous CABG	80 (11.1%)		148 (13.9%)		0.084[b]
NSTEMI presentation	482 (67.1%)		733 (68.8%)		0.401[b]
STEMI presentation	236 (32.9%)		331 (30.2%)		0.337[b]
Multivessel disease	**433 (60.3%)**		**746 (70.1%)**		**0.001**[b]
Medication at discharge					
ASA	719 (100%)		(1063) 100%		–
P2Y12 inhibitor	704 (97.9%)		1030 (96.9%)		0.19[b]
Beta-blockers	632 (87.9%)		920 (86.5%)		0.40[b]
ACE-I	654 (91.0%)		940 (88.4%)		0.09[b]
Statins	701 (97.5%)		1020 (96%)		0.08[b]

CAD-coronary artery disease, MI-myocardial infarction, PCI-percutaneous coronary intervention, CABG-coronary artery bypass grafting, CHD-coronary heart disease, CKD-chronic kidney disease, STEMI, ST-elevation myocardial infarction, NSTEMI-non ST-elevation myocardial infarction, LVEF-left ventricular ejection fraction, SD-standard deviation, ACE-I – angiotensin converting enzyme inhibitors, ASA - acetylsalicylic acid.
Statistically significant differences boldfaced.
[a] *U* Mann-Whitney test.
[b] Pearson Chi-square test.

group and individualized, supervised physical training, as well as psychological program, including group therapy and relaxation sessions. Moreover, educational sessions on lifestyle modification and coronary risk factors control were included in the program.

Follow-up data, including exact dates of deaths, MI, ischemic stroke, repeat hospitalization for HF, were obtained from the health insurer (National Health Fund).

We also recorded time to the first follow-up visit, a number of visits and the number of implanted cardiac implantable electric devices.

The study protocol was approved by the Ethics Committee of the Medical University of Silesia in Katowice.

3.1. Statistical analysis

Statistical analysis was performed with SPSS v.25.0 software (IBM Corp, Armonk, NY, USA). First, 1:1 propensity score matching using the nearest neighbor method was implemented in order to compensate for the imbalance in terms of baseline covariates between MC-AMI and the control group. The overall Hansen and Bowers balance test showed good case alignment ($p = 0.998$). Out of initial 1782 patients, the cohort of 1058 patients was incorporated into the final analysis.

Quantitative variables were specified as mean and standard deviation (SD) or median and 25–75 percentile boundaries, whereas qualitative parameters were expressed as number and percentage. Variable's type of distribution was verified using Shapiro-Wilk's test. Since all continuous variables were non-normally distributed, two-tailed Mann–Whitney *U* test was utilized to compare inter-group differences. Qualitative parameters were compared using Pearson's chi-square test. Relative risk (RR) ratios with 95% confidence intervals (95%CI) were calculated. All the variables with $p \ll 0.1$ in the univariate model were included in the Cox proportional hazards model using backward stepwise Wald's approach. The Kaplan-Meier survival curves for MC-AMI (group A) and control group (group B) were established and log-rank tests were calculated. A p value of $\ll 0.05$ was regarded as statistically significant.

4. Results

We primarily analyzed 1782 patients with AMI: 719 in MC-AMI group and 1063 in the control group (Table 1). After 1:1 propensity score matching, we selected a group of 1058 well-balanced pairs (529 in MC-AMI group and 529 in control) (baseline characteristics after PSM shown in Table 3, supplementary data).

5. Relation between MC-AMI participation and primary endpoint (MACCE)

MC-AMI was related with MACCE reduction by 40% in a 12-month observation. Number needed to treat to avoid one MACCE was 14.7 patients.

In 12-month follow-up the incidence of MACCE was significantly lower in MC-AMI group than in the control group (16.82% vs 10.00% $p \ll 0.001$). Differences in the incidence of MI, hospitalization for HF and all-cause mortality showed only a trend in favor of MC-AMI group (Table 2, Fig. 1). The incidence of stroke was significantly lower in study vs. control group (1.5% vs 0.19% $p \ll 0.019$).

Multivariable Cox regression analysis within the entire, matched cohort revealed MC-AMI participation to be inversely associated with the occurrence of primary endpoint - MACCE at 12 months (HR = 0.500, 95%CI 0.349–0.718, $p \ll 0.001$). Cox regression also revealed that older age, diabetes mellitus, hyperlipidemia, prior PAD, previous UA, and lower LVEF were

Table 2
Comparison of study endpoints between matched study group and matched control group in 12-months observation (median follow-up time 8 months).

	Total n (%) n = 1058	Matched study group n (%) n = 529	Matched control group n (%) n = 529	RR	95% CI	NNT	p[a]
All-cause mortality	40 (3.8%)	15 (2.8%)	25 (4.7%)	0.600	0.320–1.125	52.9	0.107
Hospitalization for HF	59 (5.6%)	24 (4.5%)	35 (6.6%)	0.686	0.414–1.137	48.1	0.141
Myocardial infarction	47 (4.4%)	19 (3.6%)	28 (5.3)	0.679	0.384–1.200	58.8	0.179
Stroke	**9 (0.9%)**	**1 (0.2%)**	**8 (1.5%)**	**0.125**	**0.016–0.996**	**75.6**	**0.019**
MACCE	**142 (13.4%)**	**53 (10.0%)**	**89 (16.8%)**	**0.596**	**0.433–0.818**	**14.7**	**0.001**

Statistically significant differences boldfaced.
[a] Two-tailed Pearson's Chi-square test; MACCE, Major Adverse Cardiovascular and Cerebrovascular Events.

significantly associated with the primary endpoint (Fig. 2).

5.1. HF-related hospitalizations

There were 24 patients in the study group and 35 patients in control who required hospital admission due to HF. The average number of readmission was 1.21 ± 0.66 and 1.29 ± 0.52 respectively and similar in both groups. Time to first HF-related admission was also similar in both groups (92 days interquartile range: 42 to 165 vs. 81.5 days interquartile range: 34 to168, $p = 0.894$). The HF-related hospitalization, however, was shorter in the study group than in control group (5.5 days interquartile range: 3.0 to 8.5 vs. 8.0 days interquartile range: 5.0 to 14.0 $p \ll 0.009$).

5.2. Adherence to the cardiac rehabilitation

Almost all patients in the matched study group (520 out of 529; 98.3%) were enrolled in an early cardiac rehabilitation program (ECR); 56.1% (297 out of 529 patients) were qualified for in-hospital rehabilitation, while 42.2%% (223 out of 529 patients) attended outpatient CR program. In the control group, only 75 out of 529 subjects (14.2%) participated in CR (in-hospital CR, 63 patients; ambulatory CR, 12 patients). which was significantly fewer than in MC-AMI group ($p \ll 0.001$).

Patients qualified for ambulatory CR presented with higher EF (mean EF 48%), compared to in-hospital CR group (mean EF 34%). In both groups NYHA class improved significantly during rehabilitation (ambulatory CR: 0.76 ± 0.08 vs 0.21 ± 0.02, $p \ll 0.05$, in-hospital CR: 1,82 ± 0.14 vs. 1,1 ± 0.12, $p \ll 0.05$). Changes in exercise capacity were following: ambulatory CR: 7.8 ± 0.2 vs 8.4 ± 0.3 METs, p = NS, in-hospital CR 6,1 ± 0.3 vs 7.9 ± 0.4, $p \ll 0.05$.

5.3. Revascularization and ICD/CRT implantations

Coronary artery bypass grafting (CABG) and elective PCI during follow up period were performed in 9.8% (52/529) and 4.9% (26/

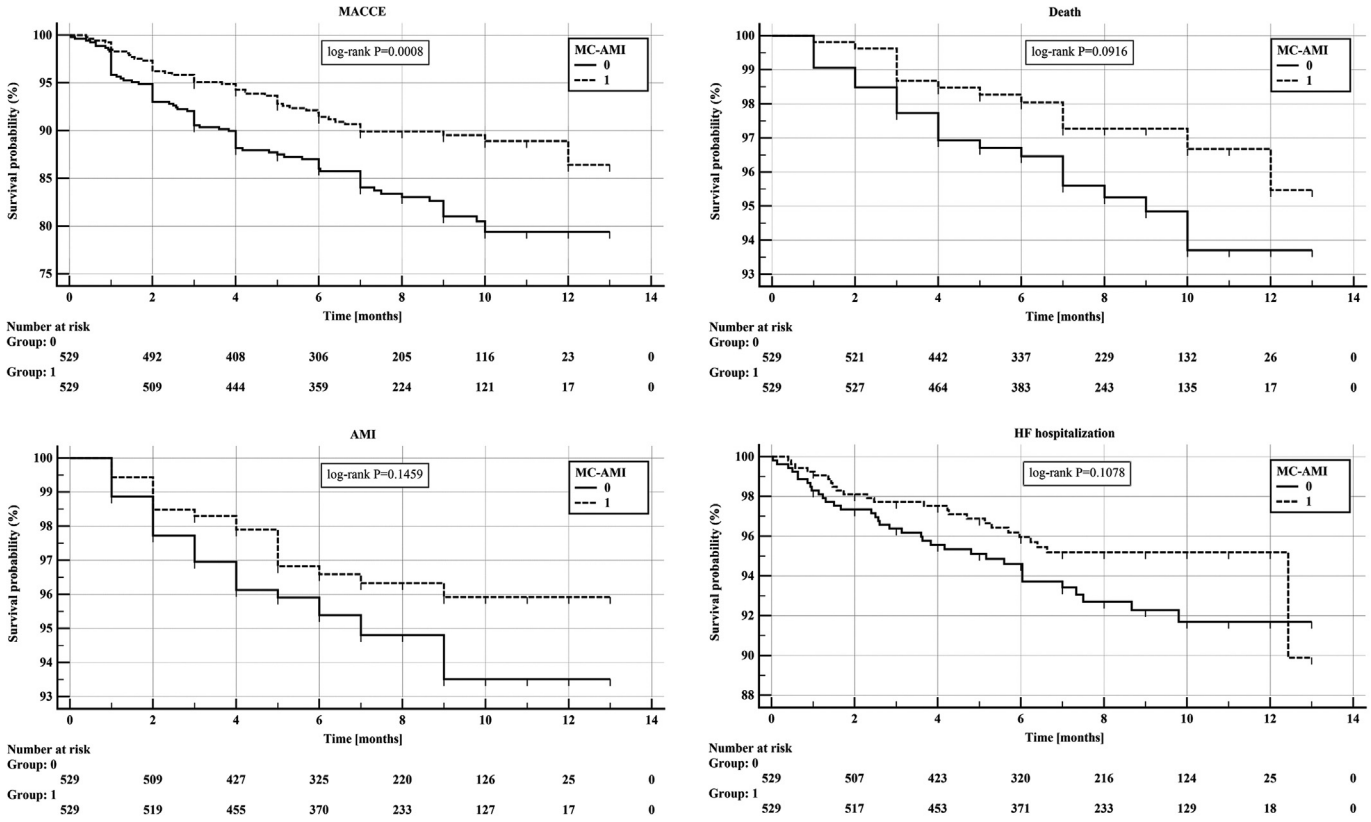

Fig. 1. Kaplan Meier curves showing freedom from all cause mortality, hospitalization for heart failure, hospitalization for myocardial infarction, MACCE- propensity score with matching- 12 months follow-up.

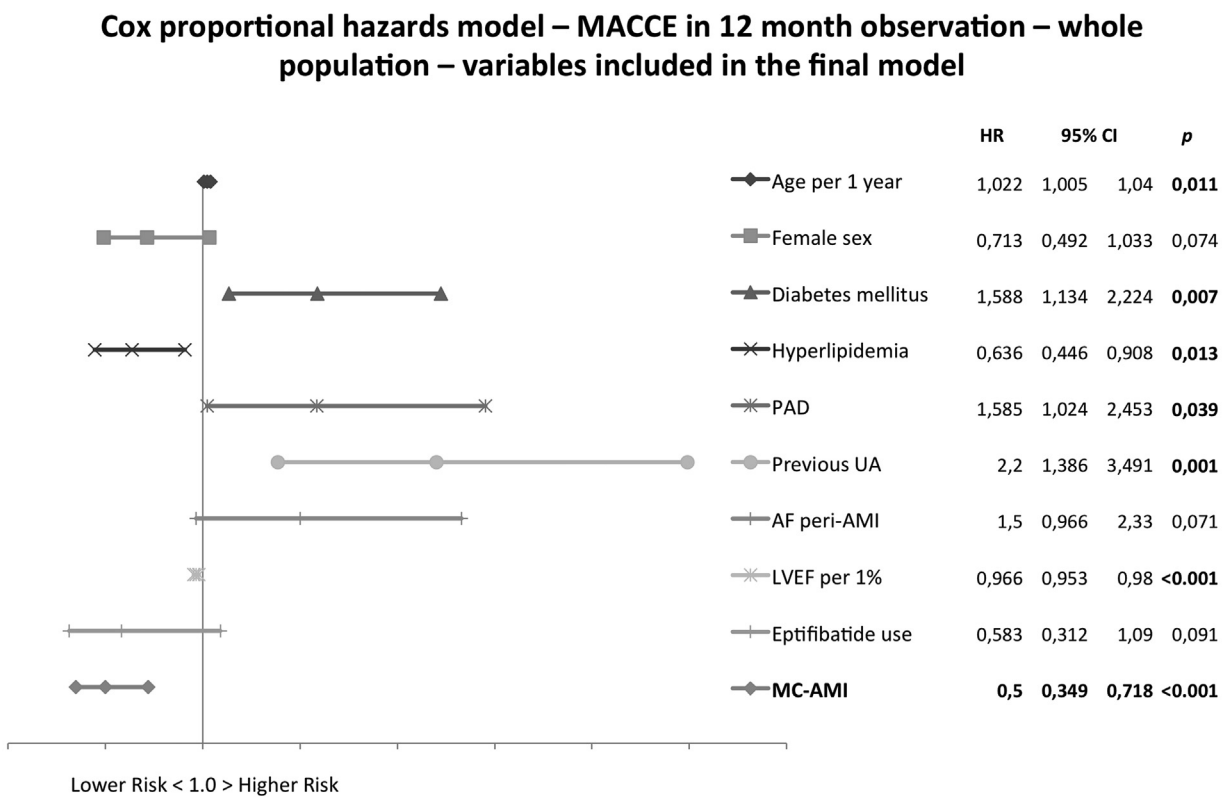

Fig. 2. Cox proportional hazards model – MACCE in 12-month observation – whole population – variables included in the final model.
*-unit HR, Overall model fit $p \ll 0.001$ PAD-peripheral artery disease, UA-unstable angina, AF-atrial fibrillation, AMI-acute myocardial infarction, LVEF-left ventricular ejection fraction, MC-AMI-managed care after acute myocardial infarction.

529) in matched study group and 3.0% (16/529) and 2.1% (11/529) in matched control group ($p \ll 0.001$, $p \ll 0.012$) respectively. ICD implantation rate was 2.8% (15 out of 529) in the matched study group, which was significantly higher than in control (0.6%; 3 out of 529). CRT-D were implanted with similar frequency in both groups (1.3%; 7/529 vs. 0.8%; 4/529 $p = 0.363$).

5.4. Outpatient cardiology care

81.5% study group patients had an outpatient cardiology visit during follow up, which was more than in the control group (56.5%; $p \ll 0.001$). A total number of outpatient visits per one patient was over twice higher in the study group (2.73 ± 1.77 vs. 1.28 ± 1.41 $p \ll 0.001$) and it was determined by a twice higher number of outpatients cardiac care visits (2.41 ± 1.76 vs. 1.25 ± 1.59 $p \ll 0.001$). Moreover, time to first post MI cardiac care visit was shorter in the study group (41 days; interquartile range: 38 to 48 vs. 67 days interquartile range: 34 to 107 $p \ll 0.0001$).

6. Discussion

Over past few years a number or articles assessed the effect of cardiac rehabilitation, complete revascularization or scheduled outpatient care as separate interventions on clinical endpoints [16,17]. There are, however, no studies assessing the effect of multi-module programs consisting of all crucial aspects of post MI care on hard clinical endpoints. This retrospective study performed in a population of MI patients in one high volume center was designed to assess the effect of MC-AMI on clinical endpoints. Results of the analysis show the benefit of MC-AMI participants. Primarily, we have shown a 40% relative risk reduction of MACCE in 12-month observation. In our cohort, in-hospital mortality was comparable in studied and control group (5.7% vs 5.9%) and similar to data reported in the literature (4–12%) [18,19]. Medical therapy and interventional treatment were also similar in both groups (although lack of information on medication adherence is a limitation). The standards of AMI treatment and the adherence of the center to recommendation did not change over study time (2016–2018). As stated, the patients in MC-AMI and control group were matched to compensate the imbalance in risk factors and major MI-related clinical data. Thus, the MACCE reduction is attributable to the management in the post-discharge period.

According to the current guidelines, post-MI patients should participate in a cardiac rehabilitation program [20]. In a large meta-analysis, Anderson et al. [21] revealed that CR reduces cardiovascular mortality by 22%, but does not affect all-cause mortality. In our study, where participation in CR was one of the crucial factors differing study and control groups, we also did not observe significant long term all-cause mortality reduction, but participation in MC-AMI reduced MACCE by 40%.

Risk reduction of recurrent MI in our observation was 32%, which is similar to MI risk reduction in 36-month follow up in Anderson's meta-analysis. A similar benefit with regard to recurrent MI was shown in studies presented by Sumner et al. [22]. The range of risk reduction in particular studies is, however, wide and many studies included in the analyses compare unadjusted groups. In our study, with adjusted groups risk reduction for recurrent MI and HF-related hospitalization did not reach statistical significance but shows a clear trend, thus pointing a benefit for MC-AMI participant, which is confirmed by MACCE reduction.

In the most complex meta-analysis by Kabboul et al. [23] (148 studies, 50,965 patients), in which not only exercise capacity, but

also nutritional counseling, risk factor modification, psychosocial management, and patient education were analyzed, authors showed that different components of complex CR program have a different effect on adverse events reduction. Not only physical training but also psychosocial management and patient education occurred to influence the endpoints. In our study, the above-mentioned components were included in the program and presumably triggered better adherence to long-term medical treatment and more frequent outpatient follow-up visits (MC-AMI vs. control: 2.73 ± 1.77 vs. 1.28 ± 1.41 per year, $p \ll 0.001$).

Complete revascularization is another crucial determinant of a long term prognosis after MI. Recent trials suggest that complete revascularization after MI is associated with better outcomes. According to a meta-analysis by Elgendy et al. [24], complete revascularization at the index procedure or as a staged procedure (either during the hospitalization or after discharge) was associated with a reduction of MACE due to a reduction in urgent revascularization. In our study the rate of scheduled revascularization was higher in MC-AMI group; there were twice more CABG procedures and 1.5 times more staged post-discharge angioplasties than in control. Importantly, in both groups multivessel PCI was performed at index hospitalization whenever appropriate, thus the number of post discharge PCI/CABG was not very high.

Despite optimal treatment, a part of MI survivors will develop heart failure with reduced ejection fraction. In these cases, implantation of ICD (or CRT-D if eligible) is recommended in primary prevention of SCD. According to EHRA White Book 2017, Poland is among developed countries with regard to the number of ICD and CRT implantations per million [25]. Current guidelines recommend ICD implantation in post-MI patients with low ejection fraction, in whom EF is reassessed 6–12 weeks after index MI and remains reduced despite optimal medical treatment [26]. Recent studies, however, show that in real-world settings only a minority of eligible patients receive the appropriate device. Pokorney et al. proved that only 67% of post-MI patients with reduced baseline EF, have their echo reassessed within 1 year, and even if it is – the ICD implantation rate for eligible patients remains low (11%) [27]. Our results confirm that strict follow-up with obligatory EF assessment doubles the number of patients referred to ICD implantation (MC-AMI: 2.8% vs. control 1.3%).

In a multivariable Cox regression model participation in MC AMI was one of the strongest negative predictors of MACCE (HR 0.5, $p \ll 0.001$) and mortality (HR 0.489, $p = 0.039$). As stated, there are no articles addressing efficacy of post AMI care systems similar to MC-AMI. We can, however, compare it to studies assessing effects of the components of MC-AMI, particularly revascularization, CR and SCD prevention.

In a CROS meta-analysis, mortality reduction for post-ACS CR participants was 0.49–0.84 in retrospective studies and 0.20–0.69 for prospective ones [28]. In large Dutch cohort, CR significantly improved 4-year survival with an HR 0.65 (95% CI 0.56–0.77), with the largest benefit observed for patients who underwent CABG and/or valve surgery (HR = 0.55, 95% CI 0.42–0.74) [29]. In our study, the benefit from MC-AMI was measured primarily in MACCE reduction and, although it is not possible to compare it directly, seems higher than in most retrospective studies.

In our opinion it is the complex approach in MC-AMI that warrants better adverse events reduction over a shorter time. The novelty in MC-AMI is the approach to execute all the guideline recommended therapeutic interventions, which are normally available within the most healthcare systems, but hardly followed accurately. Importantly, such an approach has a good perception among participants, as recently reported by Feusette, Gierlotka et al. [30].

Among other findings, MC-AMI group was characterized by shorter index MI hospitalization than in the matched control group. One explanation is that the perspective of close follow-up (screening visit 7–10 days post-discharge), allows for shortening the hospitalization (and thus treatment costs), without affecting patient's safety. Although HF-related readmissions were not less frequent in MC-AMI, the HF-hospitalizations were shorter in studied group, which suggests that the tight control in MC-AMI allows for identifying HF patients earlier and react at an early stage of HF decompensation.

Ischemic stroke is not a common endpoint in long-term post-MI observations. In our study, the incidence of stroke was significantly lower in MC-AMI group. We have not found similar findings in the available literature. One possible reason might be better adherence to antiplatelet therapy and antihypertensive in MC-AMI group, but this requires further investigation. Our study was not designed to address this issue. In Cox regression model, besides MC-AMI participation, age, diabetes, dyslipidemia, reduced EF, PAD and previous UA occurred to affect the risk of MACCE. The observations are consistent with the literature; there is however a large variety of factors taken into the analysis in different studies.

7. Limitations

The observation is a retrospective cohort study performed in tertiary and high-volume, but still one single center. Moreover, as a retrospective analysis, it provides statistical association rather than causal relationships between intervention and the clinical effect. Finally, despite very encouraging results of 12-month observation (with a median follow-up time 8 months), a longer follow-up will be necessary to prove a long-term benefit of the program.

8. Conclusions

Participation in MC-AMI improves prognosis by increasing the rate of patients undergoing cardiac rehabilitation, complete revascularization, and ICD implantation. The strategy reduces major cardiovascular and cerebrovascular events by 40% in 12-month follow-up. Moreover, participation in MC-AMI is inversely related to mortality rate, recurrent MI and hospitalization for heart failure during 12 months.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcard.2019.06.040.

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