Reviews in Cardiovascular Medicine

Original Research

Long term prognostic benefit of complete revascularization in elderly presenting with NSTEMI: real world evidence

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DOI:10.31083/j.rcm2202054

Submitted: 11 March 2021 Revised: 1 May 2021 Accepted: 8 May 2021 Published: 30 June 2021

The benefit of complete revascularization in elderly patients with non-ST elevation myocardial infarction (NSTEMI), and multivessel disease remains debated (MVD). The aim of our study was to determine the current long-term prognostic benefit of complete revascularization in this population. A retrospective cohort study of 1722 consecutive elderly NSTEMI patients was performed. Among the study participants 30.4% (n = 524) were completed revascularizated and in 69.6% (n = 1198) culprit vessel only revascularization was performed. A propensity score analysis was performed and we divided the study population into two groups: complete revascularization (n = 500) and culprit vessel only revascularization (n = 500). The median follow-up was 45.7 months, the all cause mortality (44.5% vs 30.5%, $p < 0.001$) (HR 0.74 (0.57–0.97); $p = 0.035$) and cardiovascular mortality (32.6% vs 17.4%, $p < 0.001$) (HR = 0.67 (0.47–0.94); $p = 0.021$) were significantly lower in patients with complete revascularization. In our study, we observed a long-term benefit of complete revascularization in elderly NSTEMI and MVD patients. Elderly patients should also be managed according to current guidelines to improve their long-term prognosis.

Keywords

Elderly; Revascularization; Mortality

1. Introduction

Nowadays, non-ST elevation myocardial infarction (NSTEMI) is the most frequent manifestation of acute coronary syndrome (ACS) [1]. Current guidelines recommend an invasive strategy in patients with NSTEMI in order to improves mortality and reduce long term clinical events [2, 3].

Half of NSTEMI patients have multivessel disease (MVD) in the coronary angiography [4, 5]. Recent studies have suggested that in NSTEMI patients with MVD, complete coronary revascularization (CCR) appears to be superior to culprit vessel only (CV) PCI in NSTEMI patients with MVD [6]. However, both the European Society of Cardiology and the American College of Cardiology guidelines do not specify the extent of revascularization giving a class IIa for complete revascularization in STEMI patients [3, 4, 7].

The proportion of elderly with NSTEMI will grow up in the next years and their management will become daily clinical practice challenge. Currently, 30% of the patients included in the European NSTEMI-ACS registries [8, 9] are older than 75 years. However, those patients are underrepresented in randomized clinical trials (i.e., 13% in the TRITON-TIMI 38 study and 15% in the PLATO study) [10, 11]. Also, due to a selection bias, elderly individuals enrolled in clinical trial may not be representative of the population treated in everyday clinical practice.

Elderly patients are less likely to receive evidence-based therapies and undergo an invasive strategy compared with younger patients despite of their benefits [12–15].

Indeed, the current guidelines recommend that elderly patients should be considered for an invasive strategy and, if appropriate, revascularization after careful evaluation of potential risks and benefits, estimated life expectancy, comorbidities, quality of life, and patient values and preferences [3].

Our study aims to analyze the long-term prognosis of complete revascularization (CCR) compared with culprit vessel only (CV) in a cohort of elderly patients with NSTEMI and MVD in a *real life* registry.

2. Material and methods

2.1 Study design

A retrospective study of all consecutive patients $\geq$75 years admitted for in two Spanish hospitals was performed. A total of 1722 patients were included between December 2003–December 2016 as shown in Fig. 1. Two groups were created: culprit vessel only (CV) or complete revascularization (CCR).

NSTEMI was defined according to current clinical practical guidelines [3, 4]. A standard definition of MVD was used as the presence of at least one angiographically significant non- infarct-related (non-culprit) lesion (stenosis at least 70% of the vessel diameter) that was amenable to successful

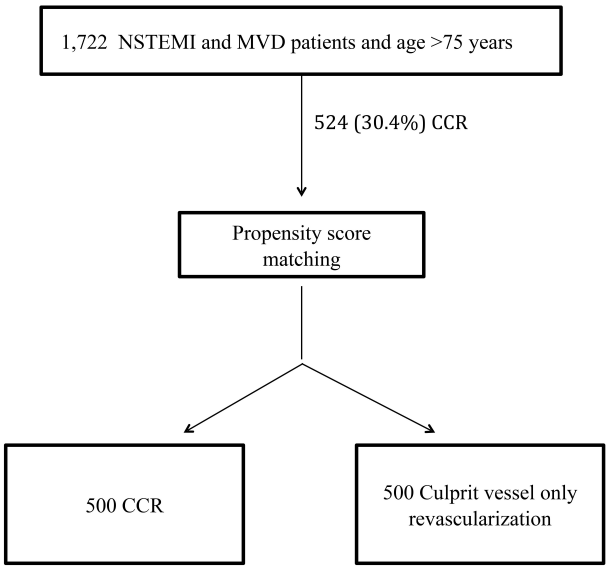

Fig. 1. Flowchart of the patients of the study.

treatment with PCI and was located in a vessel with a diameter of at least 2.5 mm that was not stented as part of the index culprit-lesion PCI.

CV revascularization was defined as revascularization of only the infarct-related artery, and complete revascularization was performed as a routine staged PCI (i.e., PCI during a procedure separate from the index PCI procedure for NSTEMI) of all suitable non-culprit lesions, regardless of whether there were clinical symptoms or there was evidence of ischemia.

Risk factors, clinical antecedents, treatments, complementary tests, and main diagnosis at discharge were collected from all patients by trained medical staff. The diagnostic and therapeutic NSTEMI protocols were made according to ESC clinical practical guidelines [2]. The antecedent of previous coronary heart disease patients and previous HF were codified according to the protocols used in previous papers of our group [16].

To estimate mortality risk we determined the GRACE score [17] and to estimate the bleeding risk we determined the the CRUSADE risk [18].

2.2 Follow-up and outcomes measures

After discharge, the follow-up of patients has been made according to our previous studies [16]. Primary endpoints assessed through follow- up were cardiovascular mortality, all-cause mortality and first major adverse cardiovascular event (MACE) that included hospital readmission for ACS, HF, stroke or bleeding as well as deaths attributable to cardiac causes.

2.3 Statistical analyses

Quantitative variables are presented as mean (Interquartile Range (IQR)) and differences were assessed by Student's *t*-test and Chi-square test. Qualitative variables are presented as percentages and differences were analyzed by analysis of variance (ANOVA) test. Survival analyses were performed after verifying the proportional risk assumption by the Schoenfeld residuals test.

We used propensity score matching to minimize the possibility that CCR was not assigned after a randomization phase [19, 20]. We applied a greedy 1 : 1 matching algorithm without replacement and defined optimal matching as a standard deviation of 0.2. First of all, a binary logistic regression where the dependent variable was CCR, and explanatory variables were age, gender, hypertension, diabetes, dyslipidemia, previous coronary heart disease, HF or stroke, GRACE score, revascularization, and medical treatments recommended at discharge was performed. Secondly two groups of 500 of patients with the same probability of receiving CCR were created. The predictive capacity of the model used to generate the propensity score was 0.79 (95% confidence interval (CI) 0.73–0.845; $p = 0.01$) with a good fit (Hosmer-Lemeshow $p = 0.13$).

All-cause mortality predictors were assessed by Cox regression models using all variables that obtained p values $<$ 0.1 in the univariate analysis or could have prognostical clinical implication; results are presented as hazard ratios (HRs) and 95% CIs. The model's discriminative accuracy was assessed by the Harrell's C-statistic, while its calibration was tested by the Grønnesby and Borgan test. We applied the model introduced by Fine and Gray [21] to test the competing events between the he incidence of recurrent ACS and the death of patients. The incidence of ACS is presented in cumulated incidence function graphs and results of the multivariate analysis as a sub-hazard ratio (sHR) and corresponding 95% CI. Patients lost during follow-up were categorized as missing, as well as those who lacked any of the main variables for the analyses, although these were very few. Statistical difference was accepted at $p < 0.05$. All analyses were performed using STATA 14.2 (StataCorp, 2009, Stata Statistical Software: Austin, TX, USA).

3. Results

3.1 Baseline characteristics of the population

A total of 1722 patients $\geq$75 years were included. The mean characteristics of the population are described in **Supplementary Table 1**. The mean age was 81.2 years and 40.2% were female. These patients presented as high-risk NTSEMI (mean GRACE 161 points). Indeed they received low rates of recommended medical therapies like aspirin (78.8%), beta-blockers (57.7%), ACEIs (58.8%), or statins (75%). In our study, 78% of patients were on clopidogrel after PCI and 22% of patients were on prasugrel or ticagrelor, in our hospital clopidogrel is the P2Y12 inhibitor of choice in patients older than 75 years, indeed we have included patients between 2003–2016, in those years, the prescription of the newer P2Y12 inhibitors in those years was lower than nowadays.

In a total of 524 patients (30.4%) CCR was performed and in 1198 (69.6%) CV revascularization was performed. When

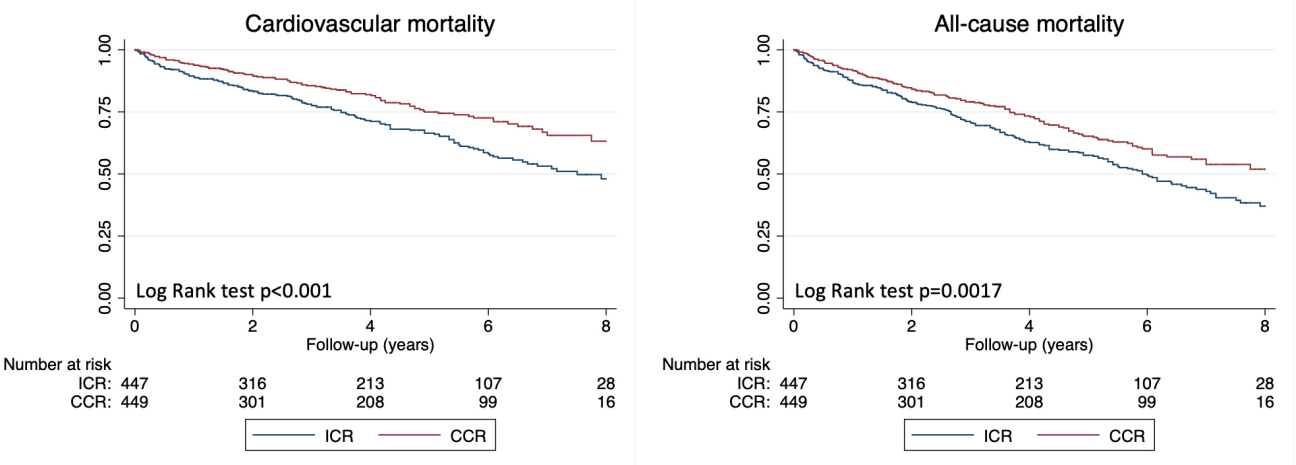

Fig. 2. Kaplan-Meyer curves for cardiovascular mortality (A) and all- cause mortality (B) through follow-up.

we compared both groups (Table 1) we observed that patients in the CCR group were younger, male, with lower rates of anemia, previous coronary artery disease, previous revascularization, and heart failure. Also, they had lower Killip class and lower GRACE and CRUSADE scores compared with those with CV revascularization. Indeed, at discharge, they were more frequently prescribed on aspirin, beta-blockers, diuretics, and statins and less on diuretics. We have not found differences between both groups in terms of the access of the angiography; in the CCR the radial access was used in 94.2% of the patients in the CV group the radial access was used in 93.1% of the patients.

We have not found differences between groups in terms of intrahospitalary complications: In the CCR group we observed 13.7% bleeding, 10.2% acute kidney injury and, 2.1% recurrent MI. In the CV group we observed 12.0% bleeding, 9.6% acute kidney injury and, 1.7% recurrent MI.

Five hundred pairs of patients with the same possibility of receiving CCR were obtained after the propensity score matching (Fig. 1). We did not observe statistical differences between groups (Table 2).

3.2 Postdischarge prognosis

The in- hospital mortality was 5.8% (56 patients) with higher rates in CV revascularization (7.3%) vs CCR (2.5%), $p = 0.005$.

The median follow-up was 45.7 months (IQR 17.4–70.0) and only 6.6% of the patients in each group were lost during the follow-up. Cardiovascular mortality was 28.1%, all-cause mortality 40.4% and, 56.1% of the patients experienced at least one MACE. As shown in Fig. 2A, cardiovascular mortality (32.6% vs 17.4%, $p < 0.001$) and all-cause mortality (44.5% vs 30.5%, $p < 0.001$) (Fig. 2B) were lower in patients with CCR compared with those with CV revascularization. However, there were no differences in MACE (Fig. 3A, $p = 0.280$) and post-discharge ACS rates (Fig. 3B, $p = 0.580$) between groups.

3.3 Multivariate analysis

The results of the multivariate analysis are presented in Tables 3 and 4. Age, previous coronary artery disease, previous heart failure, diabetes mellitus, and the GRACE score were predictors of higher cardiovascular and all-cause mortality. Complete revascularization was independently associated with 33% lower cardiovascular mortality and 26% all-cause mortality. It was not associated with lower MACE or recurrent ACS during the follow-up.

4. Discussion

In our study, we described the long-term prognostic benefit of CCR in a cohort of elderly patients with NSTEMI and MVD. To the best of our knowledge, this is the first work suggesting that CCR is associated with lower mortality during a long-term follow-up in this high-risk population. Our data suggest that elderly patients should also be managed according to current guidelines to improve their long-term prognosis. Our results support the need for further randomized studies to confirm these findings.

Currently, the proportion of elderly patients is growing worldwide. In 2030, it is expected that the proportion of patients older than 80 years could be more than 5% in Europe and Northern America [22]. However, they have been underrepresented in most clinical trials. Elderly patients are less likely to undergo an invasive strategy compared with younger patients [12, 13] and many facts [23] could influence this decision like that elderly patients are considered more likely than younger patients to suffer complications following revascularization procedures or the presence of comorbidity that could heavily influence the patient selection for an invasive strategy [24, 25]. It happens even though a randomized controlled trial has previously reported that in patients $\geq$80 years who had NSTEMI or UA, an invasive strategy, (e.g., PCI or CABG), was significantly superior to a conservative strategy with medical treatment alone in the reduction of MI, and death [26]. Indeed, consistent with this observation, an

Table 1. Clinical features of the cohort according to revascularization.

Baseline characteristics	CCR (n = 524)	Culprit vessel only (n = 1198)	*p*
Age (years), mean ± sd	80.7 ± 3.8	81.7 ± 3.4	<0.001
Female, n (%)	193 (36.8)	499 (41.7)	0.060
BMI (kg/m^2), mean ± sd	30 ± 21	28 ± 7	0.016
Previous CAD, n (%)	151 (28.8)	442 (36.9)	0.001
Previous AMI, n (%)	30 (10.5)	188 (19.4)	0.001
Previous PCI, n (%)	63 (12.0)	115 (9.6)	0.129
Previous CABG, n (%)	14 (2.7)	111 (9.3)	<0.001
Previous STROKE, n (%)	50 (9.5)	151 (12.6)	0.069
Previous HF, n (%)	32 (6.1)	132 (11.0)	0.001
CKD, n (%)	46 (8.8)	140 (11.7)	0.3074
COPD, n (%)	85 (16.2)	194 (16.2)	0.989
PAD, n (%)	38 (7.3)	143 (11.9)	0.004
Previous neoplasia, n (%)	43 (8.2)	105 (8.7)	0.050
Smoker, n (%)	40 (7.6)	64 (5.3)	0.066
Hypertension, n (%)	412 (78.6)	910 (76.0)	0.228
Diabetes, n (%)	190 (36.3)	451 (37.6)	0.584
Dislypidemia, n (%)	256 (48.9)	600 (50.1)	0.639
AF, n (%)	89 (17.0)	245 (20.5)	0.094
IN hospital management			
SBP (mmHg), mean ± SD	141 ± 26	139 ± 27	0.183
DBP (mmHg), mean ± SD	75 ± 14	73 ± 13	0.020
HR (bpm), mean ± SD	78 ± 19	80 ± 21	0.036
Troponin peak (ng/mL), mean ± SD	17 ± 84	9 ± 19	0.015
Hemoglobin (g/dL), mean ± SD	13.0 ± 1.7	12.8 ± 1.9	0.005
Creatinine (mg/dL), mean ± SD	1.1 ± 0.5	1.2 ± 0.7	0.038
eGRF (mL/min/1.72 m^2), mean ± SD	74 ± 27	71 ± 34	0.143
Glycemia (mg/dL), mean ± SD	135 ± 72	153 ± 85	<0.001
Total cholesterol (mg/dL), mean ± SD	164 ± 44	162 ± 43	0.489
LDL cholesterol (mg/dL), mean ± SD	97 ± 36	96 ± 35	0.636
LVEF, mean ± SD	55 ± 11	53 ± 12	<0.001
GRACE, mean ± SD	154 ± 29	163 ± 35	<0.001
CRUSADE, mean ± SD	27 ± 18	32 ± 19	<0.001
KILLIP n (%)			<0.001
I	424 (80.9)	810 (67.6)	
II	72 (13.8)	262 (22.0)	
III	22 (4.2)	102 (8.6)	
IV	6 (1. 2)	24 (2.0)	
Charlson index, mean ± SD	2.7 ± 2.4	2.9 ± 2.5	0.393
Medical therapy at discharge			
ASA, n (%)	490 (93.5)	867 (72.4)	<0.001
CLOPIDOGREL, n (%)	436 (83.2)	568 (47.4)	<0.001
TICAGRELOR, n (%)	29 (5.5)	9 (0.8)	<0.001
OAC, n (%)	167 (13.9)	56 (10.7)	0.064
Beta-blockers, n (%)	356 (67.9)	638 (53.3)	<0.001
ACEI/ARB, n (%)	360 (54.5)	653 (54.5)	<0.001
STATIN, n (%)	456 (87.0)	835 (69.7)	<0.001
MRA, n (%)	15 (5.3)	60 (6.2)	0.564
Diuretics, n (%)	127 (24.2)	423 (35.3)	<0.001

BMI, body mass index; CAD, coronary artery disease; AMI, acute myocardial infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting; HF, heart failure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; PAD, peripheral artery disease; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; eGRF, estimated glomerular filtration rate; LDL, low density lipoprotein; LVEF, left ventricular ejection fraction; ASA, aspirin; OAC, oral anticoagulant; ACEI, angiotensin-converting-enzyme inhibitor, ARBs, angiotensin II receptor blockers; MRA, mineralorcorticoid recepctor antagonists; SD, standar desviation.

Table 2. Clinical features of the cohort according to revascularization after the propensity score matching.

Baseline characteristics	CCR (n = 500)	Culprit vessel only (n = 500)	*p*
AGE (years), mean ± SD	81.1 ± 3.8	81.2 ± 4.0	0.692
FEMALE, n (%)	109 (21.8)	119 (238)	0.962
BMI (kg/m^2), mean ± SD	30 ± 30	28 ± 10	0.365
Previous CAD, n (%)	97 (19.4)	95 (19.0)	0.340
Previous AMI, n (%)	17 (3.4)	28 (5.6)	0.525
Previous PCI, n (%)	38 (7.6)	29 (5.8)	0.116
Previous CABG, n (%)	8 (1.6)	22 (4.4)	0.018
Previous STROKE, n (%)	27 (5.4)	42 (8.4)	0.131
Previous HF, n (%)	17 (3.4)	20 (4.0)	0.827
CKD, n (%)	23 (4.6)	30 (6.0)	0.513
COPD, n (%)	48 (9.6)	47 (9.4)	0.545
PAD, n (%)	24 (4.8)	27 (5.4)	0.926
Previous neoplasia, n (%)	16 (3.2)	13 (2.6)	0.136
Smoker, n (%)	22 (4.4)	25 (5.0)	0.901
Hypertension, n (%)	232 (46.4)	263 (52.6)	0.394
Diabetes, n (%)	115 (23.0)	119 (23.8)	0.567
Dislypidemia, n (%)	148 (29.6)	167 (33.4)	0.720
AF, n (%)	49 (9.8)	43 (8.6)	0.245
In hospital management			
SBP (mmHg), mean ± SD	139 ± 27	142 ± 28	0.208
DBP (mmHg), mean ± SD	74 ± 15	74 ± 14	0.987
HR (bpm), mean ± SD	80 ± 19	79 ± 17	0.827
Troponin peak (ng/mL), mean ± SD	27 ± 119	13 ± 26	0.121
Hemoglobin (g/dL), mean ± SD	12.9 ± 1.7	12.8 ± 1.9	0.644
Creatinine (mg/dL), mean ± SD	1.2 ± 0.6	1.1 ± 0.6	0.747
Glycemia (mg/dL), mean ± SD	135 ± 75	143 ± 82	0.243
eGRF (mL/min/1.72 m^2), mean ± SD	67 ± 23	63 ± 43	0.800
Total cholesterol (mg/dL), mean ± SD	165 ± 45	161 ± 46	0.290
LDL cholesterol (mg/dL), mean ± SD	97 ± 36	95 ± 37	0.600
LVEF, mean ± SD	54 ± 11	54 ± 11	0.577
GRACE, mean ± SD	157 ± 29	156 ± 33	0.704
CRUSADE, mean ± SD	29 ± 18	28 ± 18	0.520
KILLIP n (%)			0.753
I	400 (80.0)	379 (75.9)	
II	79 (15.7)	80 (16.0)	
III	15 (3.9)	35 (6. 9)	
IV	6 (1.2)	6 (1.2)	
Charlson index, mean ± SD	2.9 ± 2.5	2.6 ± 2.3	0.189
Medical therapy at discharge			
ASA, n (%)	464 (92.8)	440 (88.0)	0.071
CLOPIDOGREL, n (%)	391 (78.1)	389 (77.8)	0.887
OAC, n (%)	52 (10.5)	45 (9.3)	0.176
Beta-blockers, n (%)	349 (69.8)	321 (64.3)	0.608
ACEI/ARB, n (%)	341 (68.2)	345 (69.1)	0.773
STATIN, n (%)	426 (85.3)	432 (86.5)	0.748
ARM, n (%)	10 (2.1)	11 (2.2)	0.633
Diuretics, n (%)	144 (28.8)	180 (36.0)	0.059

BMI, body mass index; CAD, coronary artery disease; AMI, acute myocardial infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting; HF, heart failure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; PAD, peripheral artery disease; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; eGRF, estimated glomerular filtration rate; LDL, low density lipoprotein; LVEF, left ventricular ejection fraction; ASA, aspirin; OAC, oral anticoagulant; ACEI, angiotensin-converting-enzyme inhibitor; ARBs, angiotensin II receptor blockers; MRA, mineralorcorticoid recepctor antagonists; SD, standar desviation.

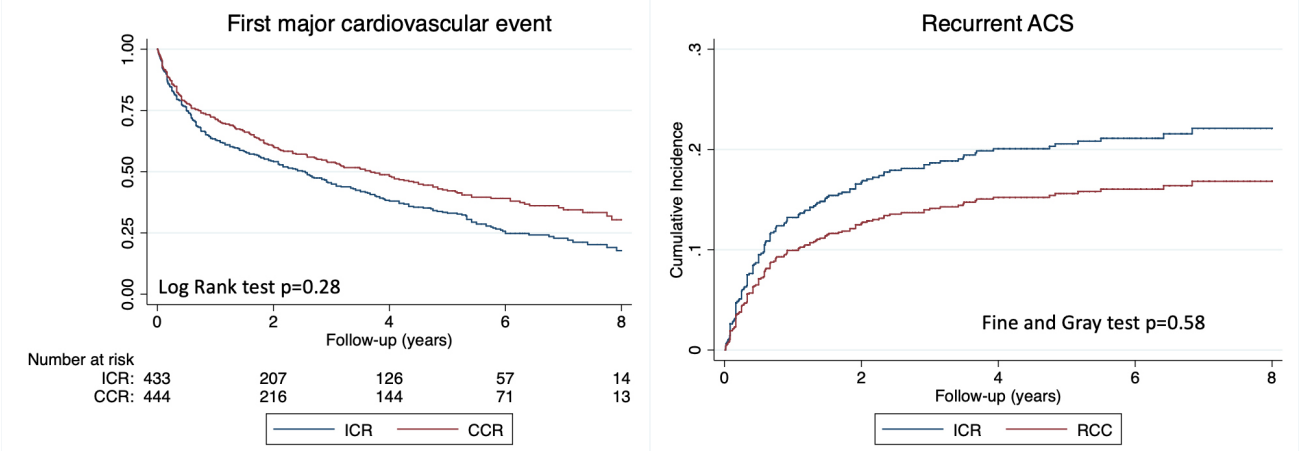

Fig. 3. Kaplan-Meyer curves for MACE (A) and recurrent ACS (B) through follow-up.

Table 3. Results of multivariate analysis.

	CV mortality	All-cause mortality	MACE
	HR (95% CI)	HR (95% CI)	HR (95% CI)
Age	1.07 (1.02–1.11); $p < 0.001$	1.06 (1.02–1.09); $p = 0.001$	1.04 (1.01–1.06); $p = 0.004$
Sex	0.88 (0.63–1.25); $p = 0.495$	0.81 (0.61–1.08); $p = 0.148$	0.83 (0.67–1.03); $p = 0.108$
Previous CAD	1.72 (1.21–2.43); $p = 0.002$	1.47 (1.10–1.96); $p = 0.008$	1.24 (0.99–1.56); $p = 0.0057$
Previous HF	2.54 (1.51–4.28); $p < 0.001$	1.97 (1.24–3.12); $p = 0.004$	1.44 (0.95–2.17); $p = 0.079$
DM	1.82 (1.29–2.56); $p < 0.001$	1.50 (1.14–1.99); $p = 0.004$	1.54 (1.24–1.91); $p < 0.001$
PAD	1.70 (0.88–2.63); $p = 0.127$	1.84 (1.22–2.74); $p = 0.004$	1.61 (1.12–2.31); $p = 0.009$
Atrial fibrillation	1.19 (0.79–1.80); $p = 0.389$	1.36 (0.98–1.88); $p = 0.062$	1.37 (1.06–1.78); $p = 0.014$
GRACE score	1.00 (1.00–1.01); $p = 0.042$	1.00 (0.99–1.01); $p = 0.050$	0.99 (0.99–1.00); $p = 0.308$
CCR	0.67 (0.47–0.94); $p = 0.021$	0.74 (0.57–0.97); $p = 0.035$	0.88 (0.71–1.08); $p = 0.226$
Beta-blockers	0.85 (0.60–1.20); $p = 0.371$	0.74 (0.56–0.97); $p = 0.031$	1.21 (0.97–1.51); $p = 0.089$

Table 4. Results of multivariate analysis.

	Recurrent ACS
	sHR (95% CI)
Age	0.97 (0.89–1.06); $p = 0.562$
Sex	0.98 (0.52–1.86); $p = 0.967$
Previous CAD	0.95 (0.50–1.78); $p = 0.877$
Previous HF	0.55 (0.11–2.60); $p = 0.454$
DM	1.59 (0.86–2.93); $p = 0.135$
Stroke	2.23 (1.06–4.71); $p = 0.034$
Atrial fibrillation	1.92 (0.87–4.23); $p = 0.101$
Beta-blockers	0.67 (0.34–1.33); $p = 0.262$
ACEIs	1.01 (0.41–2.46); $p = 0.971$
LVEF	1.00 (0.97–1.02); $p = 0.823$
CCR	0.80 (0.16–1.63); $p = 0.500$
Antiagregants	0.39 (0.05–2.99); $p = 0.371$

CV, cardiovascular mortality; MACE, major adverse cardiovascular event; HR, hazard ratio; CI, confidence interval; CAD, coronary artery disease; HF, heart failure; DM, diabetes mellitus; PAD, peripheral artery disease; CCR, complete revascularization; LVEF, left ventricular.

analysis of the German Acute Coronary Syndromes registry suggested that among patients ≥75 years of age, the invasive strategy improved short and long-term mortality [7]. Our results reinforce the hypothesis that revascularization should be performed in elderly patients to improve the long-term prognosis.

A large body of evidence exists in STEMI patients in supporting the role of CCR in patients with MVD undergoing primary PCI [27–32] and recently the benefit of CCR in NSTEMI patients with MVD has been suggested [6, 32]. However, the long-term prognosis benefit of CCR is not well known in elderly people. In our study, we observed that only 30.4% of patients were completely revascularized; this rate is lower than the 51.2% reported by Harada *et al.* [23], but it has been published that the rates of CCR could vary from 30% to 61% regardless of age [33, 34] as we observed.

For the first time, in our study, we demonstrated that in a real cohort of elderly NSTEMI patients CCR reduces long-term cardiovascular and all-cause mortality. It is associated with a 51% reduction of cardiovascular mortality and 49% reduction of all-cause mortality being the most important independent prognostic factor. Our results contrast with the recent study of Rumiz *et al.* [35] that did not find a prognostic benefit of complete revascularization in elderly people with STEMI. However, this study is performed in a different population and probably the results could not be extrapolated to our population. To our knowledge, these findings were

not previously reported and we think they may have relevant implications for the management of this prevalent group of patients.

Our study has some strengths and limitations. First of all, it was a retrospective study and it therefore is subject to the classical limitations and bias that are inherent to those studies. Although propensity score analyses are more robust than traditional regression techniques, they have certain weaknesses compared to randomized clinical trials, such as and adjustments to reduce biases effectively reduced the number of subjects. The important issue of the timing (during the index hospital admission, or during a separate hospital admission) of CCR was not addressed in this study. We do not have data about anatomical (chronic total occlusion, severe tortuosity of coronary vessels…), technical factors, or aspects of the angiography like procedure time, fluoroscopic time, and contrast volume. Also, we do not have data about the repeat revascularization during the follow-up. Finally, long-term outcomes could be modified by many circumstances that might not be available with the follow-up protocol of our center [36]. Nonetheless, since clinical features and event rates were similar to previous reports [37, 38], we believe that these limitations might not have had a major influence on the validity of our results.

However, the study includes patients with several comorbidities and is thus representative of the broad range of patients encountered in day-to-day clinical practice and it has a long term follow up comparing with most of the studies performed in elderly people who were restricted to short-term follow-up (six months).

5. Conclusions

Our study highlighted the long- term prognostic benefit of complete revascularization in elderly people ($\geq$75 years) with NSTEMI and MVD. CCR is associated with lower long-term mortality. We suggest that advanced age alone should not be regarded as a contraindication for CCR in NTSEMI and MVD.

Author contributions

RAB and AC conceived and designed the study and wrote the paper; PRV, DIÁ, BÁÁ, BD, LAR, CAJ, BCÁ collected the data; JRGJ and JMGA reviewed the paper. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Galicia (Approval Number2015/221).

Acknowledgment

We would like to thank patients participation and thank to all the peer reviewers for their opinions and suggestion.

Funding

This research received no external funding.

Conflict of interest

The authors declare no conflict of interest.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at https://rcm.imrpress.com/EN/10.31083/j.rcm2202054.

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