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RESEARCH ARTICLE

Complete revascularization with PCI in STEMI patients with multivessel disease, when is the appropriate time?

Revascularización completa mediante ICP en pacientes con STEMI y enfermedad coronaria multivaso, ¿cuál es el momento adecuado?

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Abstract

Objective: *The purpose was to compare the outcomes of patients with ST-elevation myocardial infarction and multivessel coronary artery disease undergoing one-time multivessel revascularization (OTMVR) versus in-hospital staged complete revascularization with percutaneous coronary intervention.* **Methods:** *This was a single-center, retrospective, observational, and cohort study, including data from January 2013 to April 2019. A total of 634 patients were included in the study. Comparisons were made between patients who underwent in-hospital staged complete revascularization versus OTMVR. The primary endpoint was all-cause in-hospital mortality, secondary endpoints included cardiovascular complications, all-cause new hospitalization, and mortality evaluated at 30 days and 1 year. In addition, we constructed a logistic regression model for determining the risk factors that predicted mortality.* **Results***: Of the 634 patients, 328 were treated with staged revascularization and 306 with OTMVR. About 76.7% were men, with a mean age of 63.3 years. Less complex coronary lesions and a higher proportion of the left anterior descending artery as the culprit vessel were found in the OTMVR group. Compared with staged revascularization, the primary and secondary endpoints occurred less frequently with OTMVR strategy.* **Conclusions:** *OTMVR did not generate more complications and demonstrate better clinical outcomes than in-hospital staged revascularization.*

Keywords: *Acute coronary syndromes. Complete revascularization. Multivessel coronary artery disease. Percutaneous coronary intervention. ST-elevation myocardial infarction.*

Resumen

Objetivo: *El propósito fue comparar resultados de pacientes con infarto agudo de miocardio con elevación del segmento ST y enfermedad coronaria multivaso sometidos a revascularización completa de un solo momento frente a revascularización completa por etapas mediante intervención coronaria percutánea.* **Métodos:** *Estudio cohorte observacional, retrospectivo,*

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unicéntrico, con datos de enero de 2013 a abril de 2019, incluyendo 634 pacientes. Se compararon resultados entre pacientes sometidos a revascularización completa por etapas frente a revascularización completa en un solo momento. El objetivo primario fue valorar mortalidad intrahospitalaria por cualquier causa y como objetivos secundarios se evaluaron a 30 días y 1 año las complicaciones cardiovasculares, hospitalizaciones y mortalidad. Se construyó un modelo de regresión logística para determinar los factores de riesgo que predijeron mortalidad. **Resultados:** *De 634 pacientes, 328 fueron tratados con revascularización por etapas y 306 con revascularización en una intervención. El 76.7% fueron hombres, con una media de edad de 63.3 años. En el grupo de revascularización de un solo tiempo se encontraron lesiones coronarias menos complejas y una mayor proporción de la arteria descendente anterior como vaso culpable. Comparado con el grupo de revascularización por etapas, los objetivos primarios y secundarios ocurrieron con menos frecuencia en el grupo de revascularización en un solo tiempo.* **Conclusiones:** *Comparada con la revascularización intrahospitalaria por etapas, la revascularización en una intervención lleva a mejores desenlaces clínicos sin generar más complicaciones.*

Palabras clave: *Síndromes coronarios agudos. Revascularización completa. Enfermedad arterial coronaria multivaso. Intervención coronaria percutánea. IAMCEST.*

Introduction

Multivessel coronary artery disease (MVCAD) is found in up to 40-60% of the patients presenting with ST-elevation myocardial infarction (STEMI) and worsens the prognosis proportional to the extent of coronary artery disease (CAD) severity[1-7]. Until recently, it was unclear whether patients should receive routine revascularization of angiographic or hemodynamically significant non-culprit lesions or culprit lesion-only revascularization. However, several meta-analyses suggested clinical benefit with percutaneous coronary intervention (PCI) of the non-culprit vessels (NCVs) to achieve multivessel complete revascularization (MVCR) compared with culprit vessel-only PCI[8-11]. Although the most of the studies support the concept of MVCR, the optimal timing of intervention remains uncertain. Our study aims to clarify if there exist benefits of the one-time multivessel revascularization (OTMVR) at the index procedure versus staged in-hospital multivessel revascularization in patients with STEMI and MVCAD.

Material and methods

Study population

We conducted a single-center study at Centro Médico Nacional “20 de Noviembre” ISSSTE in Mexico City. Data from January 2013 to April 2019 were included in the study.

Inclusion criteria

Adults between 18 and 75 years old with a diagnosis of STEMI and MVCAD who underwent PCI, regardless of whether it was primary, pharmacoinvasive strategy, or rescue PCI, were included in the study.

Exclusion criteria

Patients were excluded if they had left main CAD, coronary artery chronic total occlusions, cardiogenic shock on admission, previous history of PCI or coronary artery bypass grafting, chronic kidney disease with glomerular filtration rate less of 30 mL/min, and missing data (Fig. 1).

Statistical analysis

Qualitative variables were described as frequencies and proportions and were analyzed with Pearson’s independence test (χ^2) or Fisher’s exact test. Quantitative variables were analyzed with Shapiro–Wilk’s normality test and described as parametric (mean, standard deviation, and minimum-maximum) or non-parametric (median, interquartile range, and minimum-maximum). Bivariate analysis was done with Student’s t-test for parametric variables and Mann–Whitney’s test for non-parametric variables. We constructed a block-entry logistic regression model, adjusted by age and sex, for determining the risk factors that predicted mortality. Variables included in the final model were selected according to the significance obtained in the bivariate analysis. $p < 0.05$ was considered statistically significant for all analyses. Data were analyzed with STATA/IC v17 (StataCorp, College Station, Texas).

Definitions and outcomes

Mvcad

Presence of at least one significant non-infarct-related lesion was amenable to successful treatment with PCI in a vessel that was not stented as part of the index culprit

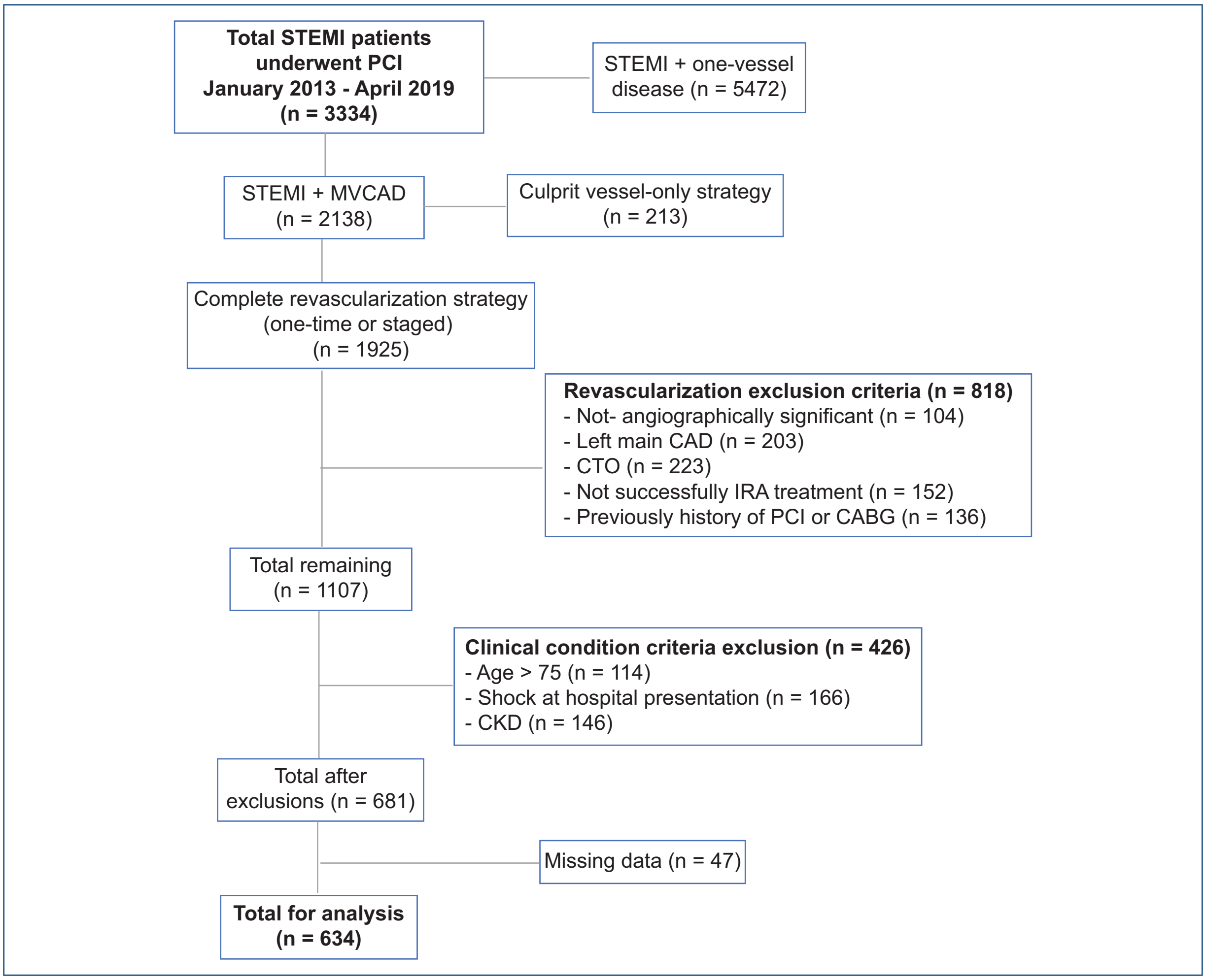

Figure 1. Patient selection process. PCI: percutaneous coronary intervention; CAD: coronary artery disease; CTO: chronic total occlusions; CABG: coronary artery bypass grafting; MVCAD: multivessel coronary artery disease; IRA: infarct-related artery; CKD: chronic kidney disease.

vessel PCI. Non-culprit lesions were deemed significant if they had 70% stenosis of the vessel diameter on visual estimation or with 50-69% stenosis accompanied by a fractional flow reserve (FFR) measurement of 0.80 or less.

In-hospital-staged complete revascularization

Initial successful PCI of IRA with a subsequent PCI in NCV in the same hospitalization was treated. The subsequent procedure could not have a PCI status of emergent, urgent, or salvage.

OTMVR

Initial successful PCI of IRA, then in the same procedure, NCVs were treated.

Endpoints

The primary endpoint was all-cause in-hospital mortality. The secondary endpoints included cardiovascular complications (ventricular arrhythmias, acute heart failure, new-onset acute coronary syndrome (ACS), stroke, and cardiogenic shock), all-cause hospitalizations, death for all causes, and death for cardiovascular causes evaluated at 30 days and 1 year.

Results

Our study included 634 patients, of which 328 were treated with staged in-hospital revascularization and 306 with OTMVR. Most of our population were men (76.7%), with mean age of 63.3 years. The OTMVR population was older with no differences in comorbidities burden

Table 1. Baseline characteristics

Variable	Total (n = 634)	SR (n = 328)	OTMVR (n = 306)	p
Female, n (%)	148 (23.3)	80 (24.4)	68 (22.2)	0.51
Male, n (%)	486 (76.7)	248 (75.6)	238 (77.8)	
Age (years)/Mean ± SD	63.3 ± 8.6	62.4 ± 8.9	64.2 ± 8.3	0.01
Overweight/obesity, n (%)	520 (82)	278 (84.8)	242 (79.1)	0.06
Hypertension, n (%)	364 (57.4)	190 (57.9)	174 (56.9)	0.78
Diabetes, n (%)	338 (53.1)	176 (53.7)	162 (52.9)	0.85
Dyslipidemia, n (%)	278 (43.8)	152 (46.3)	126 (41.2)	0.19
Previous medications, n (%)				
ARB/ACEi	280 (44.2)	118 (38.6)	162 (49.4)	< 0.01
CCB	56 (8.8)	44 (14.4)	12 (3.7)	< 0.01
Statin	134 (21.3)	68 (20.1)	66 (21.6)	0.85
Antiplatelets	28 (4.4)	12 (3.7)	16 (5.2)	0.33
Laboratories at admission/Median (IQR)				
hsTnT (ng/lt)	22280 (5468-75801)	24923 (8380-90100)	21870 (3170-67008)	0.60
NT-proBNP (pg/ml)	2370 (1045-7926)	2410 (1090-8452)	2307 (1025-7926)	0.62
Killip class, n (%)				
I	476 (75.1)	258 (78.7)	218 (71.2)	0.06
II	118 (18.6)	50 (15.2)	68 (22.2)	
III	40 (6.3)	20 (6.1)	20 (6.5)	
GRACE score/Median (IQR)	129 (112-146)	129 (110-152)	130 (113-141)	0.45
TIMI score/Median (IQR)	3 (2-5)	3 (2-5)	3 (3-5)	0.66

AF: atrial fibrillation; ARB/ACEi: angiotensin receptor blocker/angiotensin converting enzyme inhibitor; AVB: atrioventricular block; CCB: calcium channel blocker; hsTnT: high sensitivity troponin T; SD: standard deviation; IQR: interquartile range; MI: myocardial infarction; OTMVR: one-time multivessel revascularization; SR: staged revascularization; VT/VF: ventricular tachycardia/ventricular fibrillation.

between both groups. Accord to prognostic scores (Killip, GRACE, and TIMI score), there were no differences between groups. Baseline characteristics by groups are found in table 1.

About treatment, the most common reperfusion strategy was primary PCI (55.8%). Pharmacoinvasive strategy was performed in 136 patients (21.3%) and rescue PCI in 144 patients (22.7%). The most common culprit artery was the left anterior descending (LAD) in the OTMVR group (60.1%) and the right coronary artery (RCA) in the staged revascularization group (65.8%). Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX) score was used to evaluate the severity and complexity of CAD. A higher score was observed in patients in the staged group (20.7 ± 2.0 vs. 17.3 ± 2.1, $p < 0.01$). Cumulative contrast volume was higher in the staged revascularization group ($p = 0.01$). The median time to complete revascularization in the staged strategy was 3 days after the index procedure. Full description and comparison of myocardial infarction treatment are found in table 2.

According to the stent complications, we found more under expansion in the OTMVR group and stent thrombosis in the staged group. There were no differences between groups ($p = 0.63$) about contrast-induced nephropathy even though more contrast volume was used in staged revascularization group. There was no difference in other in-hospital complications such as severe mitral regurgitation, cardiogenic shock, or significant bleeding. In-hospital death was more common in the staged revascularization strategy than in the OTMVR (6.1% vs. 1.3%; $p < 0.01$), and the leading cause was cardiogenic shock and ventricular arrhythmias.

In the 30-day follow-up, the total cumulative deaths, death for cardiovascular causes, total number of all-cause hospitalizations, cardiovascular hospitalizations, new-onset ACS, and cardiogenic shock were higher in the staged revascularization strategy ($p < 0.01$). In the 1-year follow-up, the total number of all-cause hospitalizations, cardiovascular hospitalizations, new-onset ACS, total cumulative deaths, and

Table 2. Myocardial infarction treatment

Variable	Total (n = 634)	SR (n = 328)	OTMVR (n = 306)	p
Reperfusion strategy, n (%)				
Primary PCI	354 (55.8)	172 (52.4)	182 (59.5)	0.12
PI	136 (21.4)	80 (24.4)	56 (18.3)	
Rescue PCI	144 (22.7)	76 (23.2)	68 (22.2)	
Glycoprotein IIb/IIIa inhibitor, n (%)	94 (14.8)	58 (17.7)	36 (11.8)	0.04
Reasons for rescue PCI, n (%)				
No reperfusion criteria (ECG)	134 (93.0)	72 (94.7)	62 (91.1)	0.51
Persistent angina/VT/VF or cardiogenic shock	10 (7.0)	4 (5.3)	6 (8.9)	
First medical contact time (min)/Median (IQR)	150 (80-400)	127 (70-320)	180 (95-500)	< 0.01
Door-to-needle time (min)/Median (IQR)	30 (20-50)	30 (20-50)	30 (20-50)	0.66
Door-to-wire crossing time (min)/Median (IQR)	60 (50-75)	60 (50-80)	60 (45-72)	0.24
Time to pharmacoinvasive strategy (min)/Median (IQR)	410 (335-475)	422 (335-475)	395 (339-475)	0.92
Time to rescue PCI (min)/Median (IQR)	240 (200-300)	250 (210-300)	212 (200-300)	0.13
Vascular access, n (%)				
Radial	560 (88.3)	284 (86.6)	276 (90.2)	0.15
Femoral	74 (11.7)	44 (13.4)	30 (9.8)	
Culprit artery, n (%)				
LAD	284 (44.8)	100 (30.5)	184 (60.1)	< 0.01
RCA	314 (49.5)	216 (65.8)	98 (32)	
Cx	36 (5.7)	12 (3.7)	24 (7.9)	
Number of vessels, n (%)				
two vessels	418 (65.9)	214 (65.2)	204 (66.7)	0.70
three vessels	216 (34.1)	114 (34.8)	102 (33.3)	
SYNTAX score	19.2 ± 2.0	20.7 ± 2.0	17.3 ± 2.1	< 0.01
Treatment decision, n (%)				
FFR	255 (40.2)	123 (37.5)	132 (43.1)	0.14
Occlusion, %	379 (59.8)	205 (62.5)	174 (56.9)	
Number of stents/Median (IQR)	3 (3-4)	4 (3-4)	3 (2-4)	< 0.01
Cumulative contrast volume (mL)*/Median (IQR)	160 (120-230)	190 (130-250)	150 (100-220)	0.01
Days to complete revascularization/Median (IQR)	-	3 (3-4)	-	-

Cx: circumflex artery; ECG: electrocardiogram; FFR: fractional flow reserve; IQR: interquartile range; LV: left ventricle; LAD: left anterior descending artery; OTMVR: one-time multivessel revascularization; PCI: percutaneous coronary intervention; PI: pharmacoinvasive; RCA: right coronary artery; SD: standard deviation; SR: staged revascularization; VT/VF: ventricular tachycardia/ventricular fibrillation, *Cumulative contrast volume includes the sum of one or both procedures during hospitalization.

death for cardiovascular causes were also more common in the staged revascularization strategy ($p < 0.01$). Full description is shown in table 3.

Regression models for mortality prediction (Table 4) showed that the main predictor for in-hospital mortality was cardiogenic shock ($p < 0.01$). At 30-day and 1-year follow-up, the main predictors of death were cardiogenic shock ($p = 0.01$), mitral regurgitation ($p = 0.01$), new-onset ACS ($p = 0.01$), and acute heart failure on follow-up ($p < 0.01$). On the other hand, the OTMVR strategy was a predictor for the lower mortality ($p < 0.01$).

Discussion

The main finding of our study is that after a mean follow-up of 1 year, in patients with STEMI and MVCAD, the OTMVR approach had better outcomes than staged in-hospital complete revascularization. These outcomes included death for all causes, death for cardiovascular causes, cardiovascular complications, and all-cause new hospitalization. The COMPLETE trial is the largest trial about complete revascularization in patients with STEMI and MVCAD. This study confirmed that complete revascularization strategy is the therapy of choice in

Table 3. Outcomes

Variable	Total (n = 634)	SR (n = 328)	OTMVR (n = 306)	p
In-hospital outcomes				
Contrast-induced nephropathy, n x(%)	36 (5.7)	20 (6.1)	16 (5.2)	0.63
Stent complications, n (%)				
Underexpansion	6 (0.9)	0	6 (2.0)	0.02
Definite stent Thrombosis	22 (3.4)	12 (3.6)	10 (3.2)	
Arrhythmias, n (%)				
AF	24 (3.8)	12 (3.6)	12 (4)	0.01
VT/VF	24 (3.8)	20 (6.0)	4 (1.3)	
AV block	18 (2.8)	12 (3.6)	6 (2.0)	
Asystole	12 (1.9)	8 (2.4)	4 (1.3)	
Severe mitral regurgitation, n (%)	80 (12.6)	48 (14.6)	32 (10.5)	0.11
Cardiogenic shock, n (%)	30 (4.7)	16 (4.8)	14 (4.5)	0.56
Significant bleeding, n (%)	8 (1.3)	4 (1.2)	4 (1.3)	1
Death, n (%)	24 (3.8)	20 (6.1)	4 (1.3)	< 0.01
Cause of death, n (%)				
Cardiogenic Shock	12 (1.9)	8 (2.4)	4 (1.3)	< 0.01
VT/VF	8 (1.3)	8 (2.4)	0	
Sudden cardiac death	4 (0.6)	4 (1.2)	0	
Hospitalization days/Median (IQR)	6 (5-9)	7 (5-8)	6 (4-10)	< 0.01
30-day outcomes				
Total number of all-cause new hospitalizations, n (%)	89 (14.5)	63 (20.4)	26 (8.6)	< 0.01
Cardiovascular hospitalizations, n (%)	73 (11.9)	55 (17.8)	18 (5.9)	< 0.01
Acute heart failure, n (%)	19 (3.1)	9 (2.9)	10 (3.3)	0.78
VT/VF, n (%)	2 (0.3)	2 (0.6)	0	0.49
Cardiogenic shock, n (%)	6 (1)	6 (2)	0	0.01
New-onset ACS, n (%)	44 (7.2)	36 (11.7)	8 (2.6)	< 0.01
Type of ACS, n (%)				
STEMI	11 (1.8)	11 (3.6)	0	< 0.01
Non-STEMI	8 (1.3)	8 (2.6)	0	
UA	25 (4.1)	17 (5.5)	8 (2.6)	
Stroke, n (%)	2 (0.3)	2 (0.6)	0	0.49
Sepsis, n (%)	16 (2.6)	8 (2.6)	8 (2.6)	0.96
Cumulative Cause of death, n (%)				
CV death	50 (7.8)	39 (11.8)	11 (3.6)	< 0.01
Non-CV death	6 (1)	3 (1)	3 (1)	
Cumulative deaths at 30 days, n (%)	56 (8.8)	42 (12.8)	14 (4.6)	< 0.01
1-year outcomes				
Total number of all-cause new hospitalizations, n (%)	68 (11.8)	44 (15.4)	24 (8.2)	< 0.01
Cardiovascular hospitalizations, n (%)	68 (11.8)	44 (15.4)	24 (8.2)	< 0.01
Acute heart failure, n (%)	22 (3.8)	12 (4.2)	10 (3.4)	0.61
VT/VF, n (%)	0	0	0	1
Cardiogenic shock, n (%)	0	0	0	1

(Continues)

Table 3. Outcomes *(continued)*

Variable	Total (n = 634)	SR (n = 328)	OTMVR (n = 306)	p
New-onset ACS, n (%)	44 (7.6)	32 (11.2)	12 (4.1)	< 0.01
Type of ACS, n (%)				
STEMI	20 (3.5)	20 (7)	0	< 0.01
Non-STEMI	10 (1.7)	2 (0.7)	8 (2.7)	
UA	14 (2.4)	10 (3.5)	4 (1.4)	
Stroke, n (%)	2 (0.3)	1 (0.3)	1 (0.3)	0.96
Sepsis, n (%)	0	0	0	1
Cumulative Cause of death, n (%)				
CV death	59 (9.3)	48 (14.6)	11 (3.6)	< 0.01
Non-CV death	6 (1)	3 (1)	3 (1)	
Cumulative deaths at 1 year, n (%)	65 (10.2)	51 (15.5)	14 (4.6)	< 0.01

ACS: acute coronary syndrome; AF: atrial fibrillation; AVB: atrioventricular block; CV: cardiovascular; OTMVR: one-time multivessel revascularization; SR: staged revascularization; VT/VF: ventricular tachycardia/ventricular fibrillation; IQR: interquartile range; STEMI: ST-elevation myocardial infarction; UA: unstable angina.

Table 4. Regression models for mortality adjusted by age and sex

Variable	In-hospital stance HR (95% CI; p)	30-day follow-up OR (95% CI; p)	1-year follow-up OR (95% CI; p)
Age	1.00 (0.95-1.05; 0.85)	0.97 (0.94-1.00; 0.11)	0.98 (0.95-1.01; 0.41)
Male sex	0.69 (0.26-1.82; 0.46)	0.26 (0.15-0.47; < 0.01)	0.32 (0.18-0.54; < 0.01)
Diabetes	1.61 (0.69-3.78; 0.26)	1.13 (0.64-2.00; 0.65)	1.41 (0.83-2.42; 0.19)
Arrhythmias	1.11 (0.69-1.80; 0.64)	3.10 (0.17-55.6; 0.44)	-
Mitral regurgitation	1.83 (0.66-5.06; 0.23)	2.61 (1.25-5.47; 0.01)	4.31 (2.25-8.23; < 0.01)
Cardiogenic shock	17.57 (5.91-52.19; < 0.01)	13.2 (1.83-95-6; 0.01)	7.85 (1.22-50; 0.03)
OTMVR	0.19 (0.06-0.59; < 0.01)	0.33 (0.17-0.63; < 0.01)	0.26 (0.14-0.48; < 0.01)
New-onset ACS	-	5.33 (2.07-13.70; < 0.01)	5.94 (1.41-24.9; 0.01)
Acute heart failure on follow-up	-	4.56 (1.23-16.96; 0.02)	9.49 (3.19-28.5; < 0.01)
Primary PCI	1.31 (0.55-3.13; 0.53)	1.58 (0.87-2.86; 0.12)	1.34 (0.78-2.31; 0.28)
Pharmacoinvasive strategy	0.86 (0.28-2.61;0.80)	0.60 (0.28-1.28; 0.18)	0.58 (0.28-1.19; 0.13)
Rescue PCI	0.75 (0-25-2.23; 0.61)	0.83 (0.40-1.73; 0.62)	1.08 (0.57-2.07; 0.80)

ACS: Acute coronary syndrome; CI: confidence interval; HR: hazard ratio; OR: odds ratio; OTMVR: one-time multivessel revascularization; PCI: percutaneous coronary intervention.

these patients[11]. About the best moment of complete revascularization, some studies suggest that OTMVR may be associated with greater mortality risk[12,13], others such as that Hu et al. have been proposed that staged revascularization is the best approach[14]. An updated meta-analysis of randomized trials did not demonstrate evidence of a significant interaction between the timing of intervention; that is, there was a consistent treatment effect for complete revascularization versus infarctrelated artery PCI, regardless of the timing when complete revascularization was achieved[15]. In terms of population, the most of the studies had a clear predominance of the male sex around 70-80% and mean age around 60-64 years old[11,16,17]. Our study showed the same sex ratio and same age. It is essential to mention that our population had a high burden of comorbidities, mainly a higher prevalence of diabetes than other reports[11,13,17]. Few studies describe the distribution of coronary lesions. In the COMPLETE trial[11], RCA was found in a more significant proportion as the IRA. In the study written by Cui et al., LAD is reported as the main culprit vessel in diabetic patients[18]. In our study in the OTMVR group, the mainly IRA was proximal LAD, while in the staged revascularization group was RCA. We suggest that this difference can directly impact outcomes because better angiographic success has been observed in PCI on proximal LAD versus proximal circumflex artery/RCA and non-proximal LAD groups[19]. It was decided to use the SYNTAX score to evaluate the severity and complexity of CAD[20,21]. Our study showed a higher score in patients in the staged revascularization group which means that these patients had more severe and complex coronary lesions. Accord the reperfusion strategy, primary PCI was carried out in 55.8% of the total population, higher than reported by another Mexican trial[22], with a door to wire crossing time according to what is suggested by the current guidelines. Compared to the previous studies[11,16,18,23,24], our population had a higher proportion of radial approach and use of drug-eluting stents. We also emphasized the fact that almost 50% of our population underwent an FFR-guided reperfusion strategy. Regarding complications, it is essential to highlight that there was no more contrast-induced nephropathy and no greater incidence of major bleeding between both groups. These results differ from the previous studies[13], but others have found similar results[15].

Regression analysis showed that the main predictors for mortality were: cardiogenic shock, new-onset ACS, acute heart failure on follow-up, and mitral regurgitation. These factors have been extensively related to mortality in the previous studies[25,26]. Surprisingly OTMVR strategy proved to be a predictor of the lower mortality. This result differs from the previous studies where this strategy proved to be an independent predictor of mortality[13], while other studies found a similar hazard ratio for mortality comparing staged PCI with OTMVR among patients who presented with ACS[14].

Conclusions

The complete revascularization strategy should be performed in all patients with STEMI and MVCAD. Regarding the best time to perform treatment of NCV, our results showed that in selected patients, OTMVR at the index procedure could be considered as the best revascularization strategy as it does not generate more complications and demonstrate a decrease in mortality, MACE, and hospital readmissions compared to staged strategy.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the informed consent of the patients and/or subjects referred to in the article.

Supplementary data

Supplementary data is available at (DOI: 10.24875/ACM.21000375). These data are provided by the corresponding author and published online for the benefit of the reader. The contents of supplementary data are the sole responsibility of the authors.

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