CMR analysis of the cardioprotective effects of chronic statin therapy prior to first STEMI: a propensity score analysis

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Background: In addition to their lipid-lowering properties, statins possess cardioprotective effects. However, the impact of the latter on acute cardioprotection and adverse left ventricular (LV) remodelling following ST-elevation myocardial infarction (STEMI) have not been investigated through cardiac magnetic resonance (CMR) analysis to date.

Purpose: To investigate the cardioprotective effects of chronic oral statin treatment prior to first STEMI.

Methods: The study included 1236 patients with a first STEMI and a CMR performed during the index admission. Among them, 923 underwent a second CMR at 6 months follow-up. The effects of chronic oral statin treatment prior to STEMI on acute infarct size (IS) as a percentage of LV mass, LV ejection fraction (LVEF), microvascular obstruction (MVO), and changes in LV end-diastolic volume (EDVi) and end-systolic volume indexes (ESVi)] at 6 months were evaluated. A propensity score to receive treatment prior to STEMI with statins was calculated based on the inverse probability of treatment weighting (IPTW) from the following parameters: age on admission, sex, smoking status, type 2 diabetes, hypertension, family history of coronary artery disease, current co-treatments (ACEis/ARBs and/or beta-blockers), heart rate (HR), blood pressure (BP) and creatinine levels on admission, and pre-PCI TIMI flow in the culprit artery. Results were stratified according to a symptom-to-balloon time (S2Bt) $\leq$ or $>$3 hours.

Results: The study population's median age was 59 years (IQR 50–68), 16.3% were women; 18.9% were receiving treatment with statins prior to STEMI (table 1). Despite no effect on MVO occurrence (OR: 0.81 [0.60; 1.09], p=0.166), prior treatment with statins was associated with a reduction in IS (18.43% [16.67; 20.19] vs 21.50% [20.67; 22.34], p=0.002), particularly among subjects with $\leq$3 hours of S2Bt. Accordingly, prior treatment with statins conferred a benefit in mean baseline LVEF (50.23% [48.73; 51.73] vs 48.15% [47.43; 48.87], p=0.014). At 6 months, treatment with statins prior to STEMI blunted the changes in EDVi and ESVi, but only among patients with $\leq$3 hours of S2Bt (table 2). In addition, a reduction in the probability of adverse LV remodelling, defined as an increase in ESVi $>$10%, was observed in statin pre-treated patients (OR: 0.67 [0.45; 0.99], p=0.043).

Conclusion: Treatment with statins before STEMI is associated with improved indexes of cardioprotection as assessed by CMR, particularly among subjects with S2Bt $\leq$3 hours. Those effects seem to have an impact in limiting adverse LV remodelling as early as 6 months follow-up, and a greater than 10% change in ESVi. These findings warrant further and prospective evaluation of the potential cardioprotective effects of chronic oral statin treatment prior to STEMI.

Table 1. Baseline population characteristics for patients with 2 CMR studies and sorted by statin use prior to first STEMI

		All participants N=923	Statin nonusers N=749	Statin users N=174	Standardized difference	
					Raw	IPTW
Demographic parameters						
Age, years		59 (50 - 68)	58 (49 - 67)	64 (55 - 70)	0.4540	0.0255
Female sex		150 (16.3)	105 (14.0)	45 (25.9)	-0.300	0.0037
Cardiovascular risk factors						
Smoking status	Active/Ex	584 (63.3)	495 (66.1)	89 (51.2)	-0.307	0.0105
	Never	339 (36.7)	254 (33.9)	85 (48.9)		
Diabetes type 2		166 (18.0)	110 (14.7)	56 (32.2)	0.4222	.0667
Hypertension		425 (46.1)	310 (41.4)	115 (66.1)	0.5114	0.0050
FH of CAD		133 (14.4)	98 (13.1)	35 (20.1)	0.1898	-0.005
Parameters measured on admission for STEMI						
Symptom-to-balloon time, minutes		190 (135 - 300)	190 (130 - 268)	190 (135 - 300)	-0.032	-0.172
Heart rate, bpm	≤ 60	149 (16.1)	121 (16.2)	28 (16.1)	0.0239	0.1275
	61 - 100	712 (77.1)	579 (77.3)	133 (76.4)		
	> 100	62 (6.7)	49 (6.5)	13 (7.5)		
Blood pressure, mmHg	≤ 140	624 (67.6)	521 (69.6)	103 (59.2)	0.2177	0.0222
	> 140	299 (32.4)	228 (30.4)	71 (40.8)		
Mean creatinine (SD), mg/dL		0.94 (0.33)	0.94 (0.32)	0.95 (0.39)	0.0499	-0.028
Pre-PCI TIMI flow	0	623 (67.5)	498 (66.5)	125 (71.8)	-0.170	0.0232
	1	55 (6.0)	40 (5.3)	15 (8.6)		
	2	95 (10.3)	76 (10.2)	19 (10.9)		
	3	150 (16.3)	135 (18.2)	15 (8.6)		
Active co-treatments prior to STEMI						
ACE-inhibitors/ARBs		207 (22.4)	136 (18.2)	71 (40.8)	0.5128	0.0252
Beta-blockers		56 (6.1)	28 (3.7)	28 (16.1)	0.4225	0.0076

Data are numbers (%) or medians (p25-p75) unless stated otherwise.

Abbreviations: ACE, angiotensin converting enzyme; ARBs: angiotensin receptor blockers; CAD: coronary artery disease; FH: family history; IPTW: inverse probability of treatment weighting; PCI: percutaneous coronary intervention; STEMI: ST-elevation myocardial infarction; TIMI: thrombolysis in myocardial infarction.

Table 2. IPTW analysis of variance for CMR analyses outcomes at 6 months post-MI (N=923)

		S2Bt ≤ 3 h			S2Bt > 3 h		
		LS Mean	95% CI	p-value	LS Mean	95% CI	p-value
CMR analyses of acute post-MI effects							
IS, %	Statin users	17.68	15.24, 20.11	0.024	19.69	17.19, 22.20	0.072
	Statin nonusers	20.81	19.59, 22.03		22.22	21.07, 23.37	
MVO score	Statin users	502.20	450.54, 553.86	0.430	540.32	485.67, 594.97	0.401
	Statin nonusers	525.46	499.42, 551.51		566.29	540.03, 592.55	
LVEF, %	Statin users	49.62	47.61, 51.64	0.412	50.58	48.38, 52.78	0.015
	Statin nonusers	48.68	47.66, 49.69		47.56	46.53, 48.59	
CMR analyses at 6 months post-MI							
EDVi, mL/m2	Statin users	-0.02	-0.07, 0.03	0.040	0.08	0.03, 0.13	0.285
	Statin nonusers	0.04	0.01, 0.06		0.05	0.03, 0.07	
ESVi, mL/m2	Statin users	-0.08	-0.15, -0.01	0.053	0.03	-0.04, 0.10	0.652
	Statin nonusers	0.00	-0.04, 0.03		0.01	-0.02, 0.04	

Abbreviations: CMR: cardiac magnetic resonance; EDVi: end-diastolic volume index; ESVi: end-systolic volume index; IPTW: inverse probability of treatment weighting; IS: infarct size; LS Mean: least squares mean; LVEF: left ventricular ejection fraction; MI: myocardial infarction; S2Bt: *symptom-to-balloon* time.