Determinants and prognostic relevance of aortic stiffness in patients with recent ST-elevation myocardial infarction

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Background

The association between aortic stiffness, cardiovascular risk factors and prognosis in patients with recent ST-elevation myocardial infarction (STEMI) is poorly understood. We analyzed the relationship between cardiovascular risk factors and arterial stiffening and assessed its prognostic significance in patients with recent STEMI.

Methods

We prospectively enrolled 408 consecutive patients who sustained a first STEMI and underwent primary percutaneous coronary intervention (PPCI). Aortic pulse wave velocity (PWV), a direct measure of aortic stiffness, was determined by the transit-time method using velocity-encoded, phase-contrast cardiac magnetic resonance imaging. Patient characteristics were acquired at baseline and major adverse cardiac and cerebrovascular events (MACCE) were assessed at 13 (interquartile range [IQR] 12–31) months. Cox regression- and logistic regression analysis were performed to explore predictors of PWV and MACCE.

Results

	Total population (n=408)	PWV <6.6 m/s (n=200, 49%)	PWV ≥6.6 m/s (n=208, 51%)	p-value
Age, years	57 [50-66]	52 [47-57]	64 [55-71]	<0.001
Female, n (%)	67 (16)	23 (12)	44 (21)	0.009
Body mass index, kg/m²	26.2 [24.6-28.7]	26.5 [24.7-28.7]	26.2 [24.6-28.7]	0.712
Hypertension, n (%)	203 (50)	71 (36)	134 (64)	<0.001
Current smoker, n (%)	223 (55)	130 (65)	93 (45)	<0.001
Pack years	20 [0-40]	25 [7 - 40]	15 [0-40]	0.021
Hyperlipidemia, n (%)	222 (54)	107 (54)	115 (55)	0.717
Diabetes mellitus, n (%)	47 (12)	17 (9)	30 (14)	0.061
Delay, minutes	192 [125-329]	179 [122-309]	207 [136-349]	0.048
Peak hs-cT, ng/L	5035 [2115-8920]	4517 [1869-8444]	5366 [2428-9346]	0.066
Peak NT-proBNP, ng/L	1146 [547-2273]	909 [487-1852]	1362 [655-3020]	<0.001
CMR parameters				
PWV, m/s	6.6 [5.6–8.3]	5.6 [5.2-6.1]	8.3 [7.3-9.9]	<0.001
IS, % LVMM	15.2 [7.0-24.6]	13.9 [6.0-24.4]	16.5 [8.7-25.1]	0.184
LVEF baseline, %	52.4 [44.8-58.9]	54.2 [45.7-60.0]	50.8 [50.8-57.7]	0.035
MVO, n (%)	210 (52)	99 (50)	111 (53)	0.179

Table 1. Baseline characteristics

Median aortic PWV was 6.6 m/s (IQR 5.6–8.3m/s). In multivariable analysis, age (odds ratio [OR] 1.10, 95% confidence interval [CI], 1.08–1.14, p<0.001) and hypertension (OR 2.45, 95% CI, 1.53–3.91, p<0.001) were independently associated with increased PWV. Sex, diabetes, smoking status, dyslipidemia, and obesity were not significantly associated with PWV in adjusted analysis (all p>0.05). High PWV significantly and independently predicted occurrence of MACCE in adjusted analysis (hazard ratio [HR] 2.45, 95% CI 1.19–5.04, p=0.014).

	Univariable		Multivariable	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age, years	1.11 (1.09-1.14)	<0.001	1.10 (1.08-1.14)	<0.001
Female sex	0.48 (0.28-0.84)	0.009	…	
Hypertension	3.29 (2.19-4.94)	<0.001	2.45 (1.53-3.91)	<0.001
Current smoker	0.44 (0.29-0.65)	<0.001	…	
Hyperlipidemia	1.08 (0.73-1.59)	0.717		
Diabetes mellitus	1.81 (0.97-3.41)	0.064		
Peak NT-proBNP	1.00 (1.00-1.00)	0.003	…	
Number of diseased vessels	1.70 (1.27-2.29)	<0.001	1.42 (1.00-2.01)	0.049

Table 2. Logistic Regression Analysis for Prediction of PWV ≥6.6 m/s

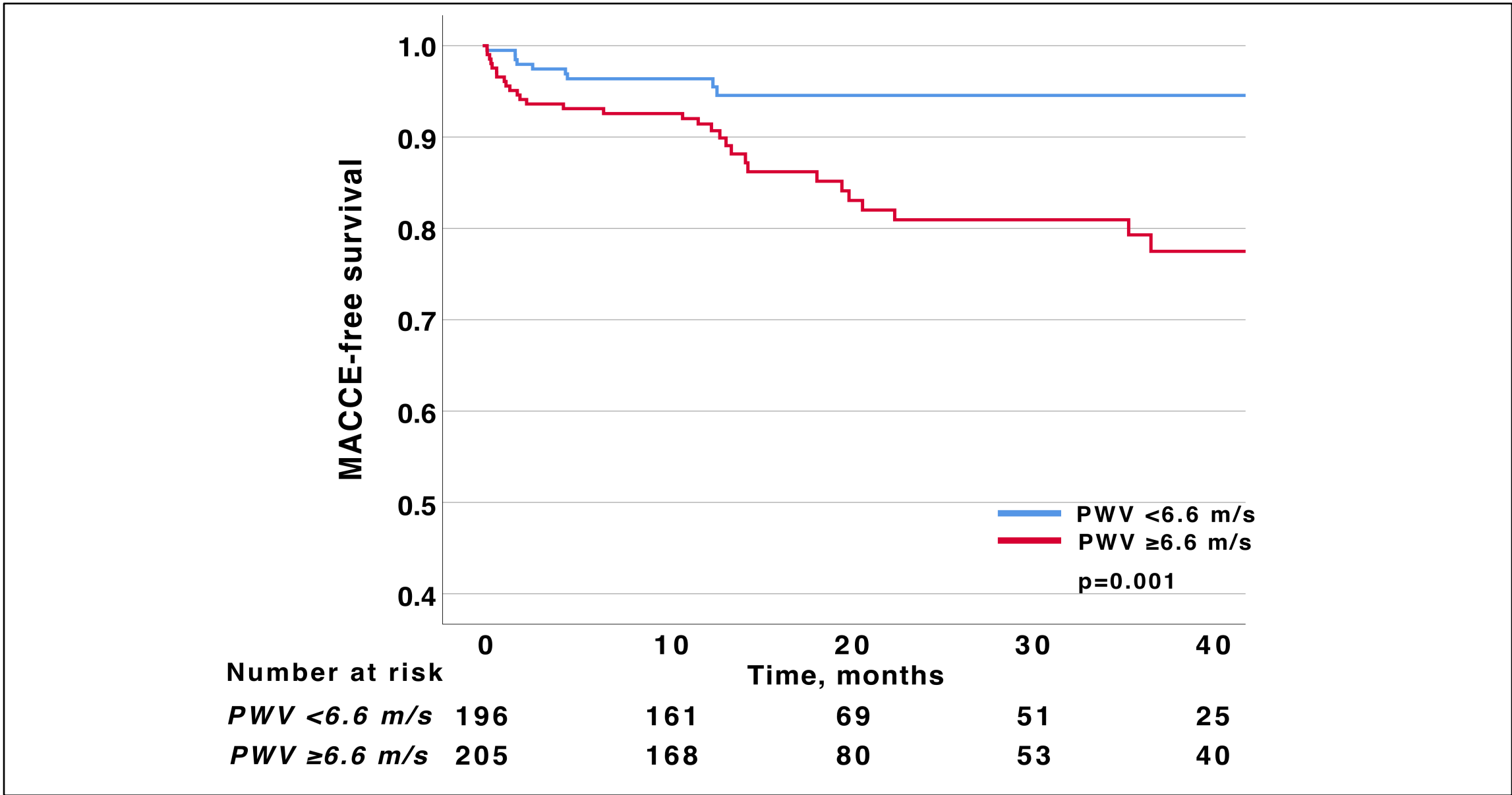| Number at risk	0	10	20	30	40
PWV <6.6 m/s	196	161	69	51	25
PWV ≥6.6 m/s	205	168	80	53	40

Figure 1: Relationship between PWV and clinical outcome

Conclusion

In patients with recent STEMI, the impact of classical cardiovascular risk factors on aortic stiffness is mainly dependent on age and increased blood pressure. Increased aortic stiffness is associated with adverse clinical outcome post-STEMI, suggesting it as a relevant therapeutic target in this population.