

Trajectories and determinants of myocardial work indices in patients with acute myocardial infarction after primary percutaneous coronary intervention

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Backgrounds: The myocardial work indices (MW indices) are novel echocardiographic parameters that quantify myocardial deformation and concomitant left ventricular pressure. However, there is little current data on trajectories and determinants of MW indices after acute myocardial infarction (AMI).

Purpose: We aimed to evaluate the trajectories of myocardial work indices and their relationship with left ventricle (LV) functional recovery and remodelling in patients with AMI after primary percutaneous coronary intervention (PCI).

Methods: Thirty-one prospectively recruited patients (28 men; mean age, 64 ± 9 years) underwent transthoracic echocardiography 7.7 $\pm$ 3.8 days after PCI for the first ST-elevation AMI. LV function was evaluated at baseline and the 6-month follow-up. MW index (MWI), constructive MW (CMW), myocardial wasted work (MWW), MW efficiency, and (MWE) were measured globally and segmentally. The myocardial area at risk (AAR) and the remote area were based on the culprit coronary arterial segment, determined from the invasive coronary angiography. Levels of troponin T and NT-proBNP were assessed.

Results: The mean LV end-diastolic volume (EDV), LV end-systolic volume (ESV), LV ejection fraction (EF), and global longitudinal strain were similar at baseline and the 6-month follow-up (94.7 ± 27.7 vs 93.6 ± 30.1 ml, $p=0.7$, 42.7 ± 17.1 vs 40.8 ± 19.1 ml, $p=0.4$, 55.8 ± 6.9 vs $57.5 \pm 7.3\%$, $p=0.2$, and -14.9 ± 4.6 vs $-15.4 \pm 3.9\%$, $p=0.3$, respectively). The global MWI, MCW, MWW and were significantly improved at the 6-month follow-up ($p<0.001$, $p<0.001$, $p=0.002$, and $p=0.03$, respectively). Furthermore, in AAR, regional MWI, MCW, and MWW values significantly improved at the 6-month follow-up (all $p<0.001$), whereas no changes in MWE were observed. MWI and MCW significantly improved in the remote areas ($p<0.001$, and $p=0.02$, respectively), but other indicators remained unchanged (Table 1). The global MWI and MCW values at baseline were inversely correlated with peak levels of troponin T ($r=-0.60$, $p<0.001$, and $r=-0.52$, $p=0.002$, respectively) and NT-proBNP ($r=-0.49$, $p=0.007$, and $r=-0.47$, $p=0.01$, respectively). Furthermore, the global MWI and MCW showed a significant positive correlation with EF at baseline ($r=0.66$, $p<0.001$, and $r=0.56$, $p<0.001$, respectively) and 6-month follow-up ($r=0.68$, $p<0.001$, and $r=0.69$, $p<0.001$, respectively), but a negative correlation with ESV (Figure 1). However, there was no significant correlation between MW indices and EDV.

Conclusion: Patients with AMI who underwent primary PCI showed improved global and regional LV performance 6 months post-infarction, as demonstrated by MW indices. Decreased global MWI and MCW are associated with higher baseline levels of NT-proBNP, higher baseline levels of troponin T, reduced EF, and increased end-systolic volume. These results provide evidence that MW indices are potential markers of the severity of myocardial injury and remodelling after AMI.

Table 1: Changes in echocardiographic variables between baseline and 6- month follow-up

	Baseline	Follow-up	P value
Global variables			
LS (%)	-14.9±4.6	-15.4±3.9	0.3
MWI (mm Hg %)	1317.79±405.09	1711.97±533.75	<0.001
CMW (mm Hg %)	1683.1±466	1997.74±574	<0.001
MWW (mm Hg %)	213.38±137.45	117.66±96.56	0.002
MWE (%)	92.29 (88 - 95)	93.94 (89 - 96)	0.03
Regional variables			
Area at risk			
LS (%)	-12.5±9.5*	-14.5±9 **	0.005
MWI (mm Hg %)	1172.82±483.5*	1552.02±562.41*	<0.001
CMW (mm Hg %)	1370.55±453.51*	1745.81±610.69*	<0.001
MWW (mm Hg %)	284.62±232.98	157.24	<0.001
MWE (%)	87.75 (81-95) *	92.2 (84 - 96) **	0.05
Remote area			
LS (%)	-15.71±9.4	-17.2±9	0.2
MWI (mm Hg %)	1577±509.28	1868.35±518.59	<0.001
CMW (mm Hg %)	2018.92±642.16	2224.13±604.45	0.02
MWW (mm Hg %)	207.53±206	166.85	0.4
MWE (%)	95 (86 - 98)	95 (91- 99)	0.8

LS, longitudinal strain; MWI, myocardial work index; MWE, myocardial work efficiency; CMW, constructive myocardial work; MWW, myocardial waste work. * P<0.001 vs. remote area, ** p<0.01 vs. remote area.

