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Cardiovascular magnetic resonance derived pressure volume loop variables in patients with ST-elevation myocardial infarction provide physiological information beyond ejection fraction



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Background

A novel non-invasive method for generation of pressure volume loops (PV-loops) using brachial blood pressure and cardiovascular magnetic resonance (CMR) imaging has recently been presented and validated (1).

The aim was to investigate if PV-loop variables could provide incremental diagnostic information beyond conventional measurements in patients with acute myocardial infarction (MI).

Method

- 100 patients with ST-elevation MI and CMR 2-6 days after MI
- 75 healthy volunteers with CMR
- Non-invasive PV-loops were measured by volumetric CMR data and brachial sphygmomanometric pressure (1)
- Maximal elastance (E_{max} = contractility), stroke work and ventriculoarterial coupling (E_a/E_{max}) were measured from the PV-loops (see **Figure 1** for examples)
- Infarct size was assessed by late gadolinium enhancement
- Myocardium at risk was assessed by contrast-enhanced steady state free precession

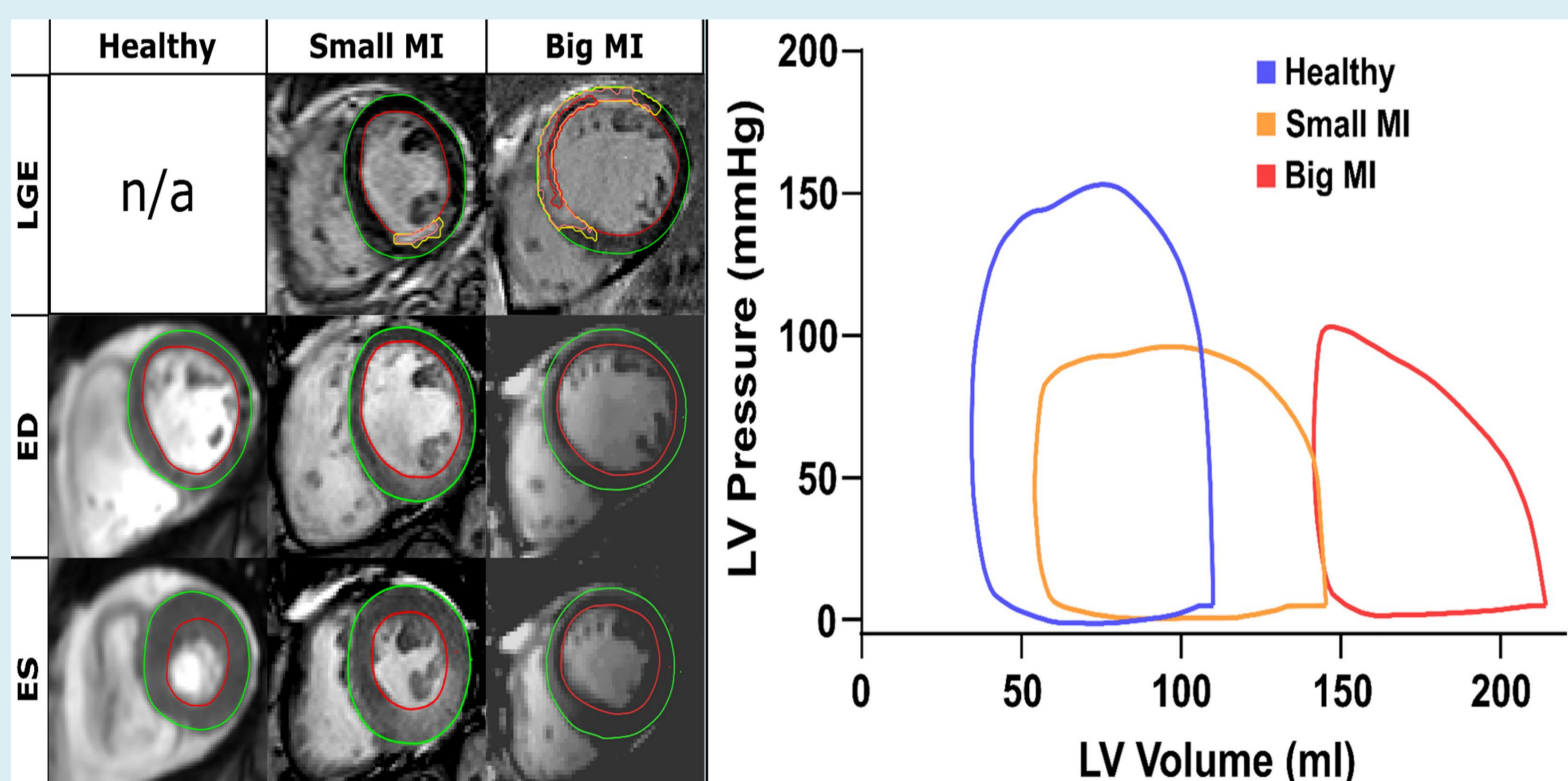


Figure 1. Example of PV-loops in patients with myocardial infarction.

Variables	Myocardial infarction	Healthy volunteers	P-value
Contractility, mmHg/mL	1.34±0.48	1.50±0.41	0.024
Ventricular arterial coupling	1.27±0.61	0.73±0.17	<0.001
Stroke work, J	0.96±0.32	1.38±0.32	<0.001
EDV, mL	166.5±34.0	174.3±32.9	0.131
EF, %	48.6±10.0	61.0±5.9	<0.001

Table 1. PV-loop variables in patients with myocardial infarction and healthy volunteers.

Results

All PV-loop variables differed significantly in patients with acute myocardial infarction compared to healthy volunteers (**Table 1**). Furthermore, contractility, stroke work and ventriculoarterial coupling correlated to infarct size (E_{max} : $r^2=0.29$, E_a/E_{max} : $r^2=0.41$, stroke work: $r^2=0.25$) and myocardium at risk (E_{max} : $r^2=0.25$, E_a/E_{max} : $r^2=0.36$, stroke work: $r^2=0.21$) as shown in **Figure 2**.

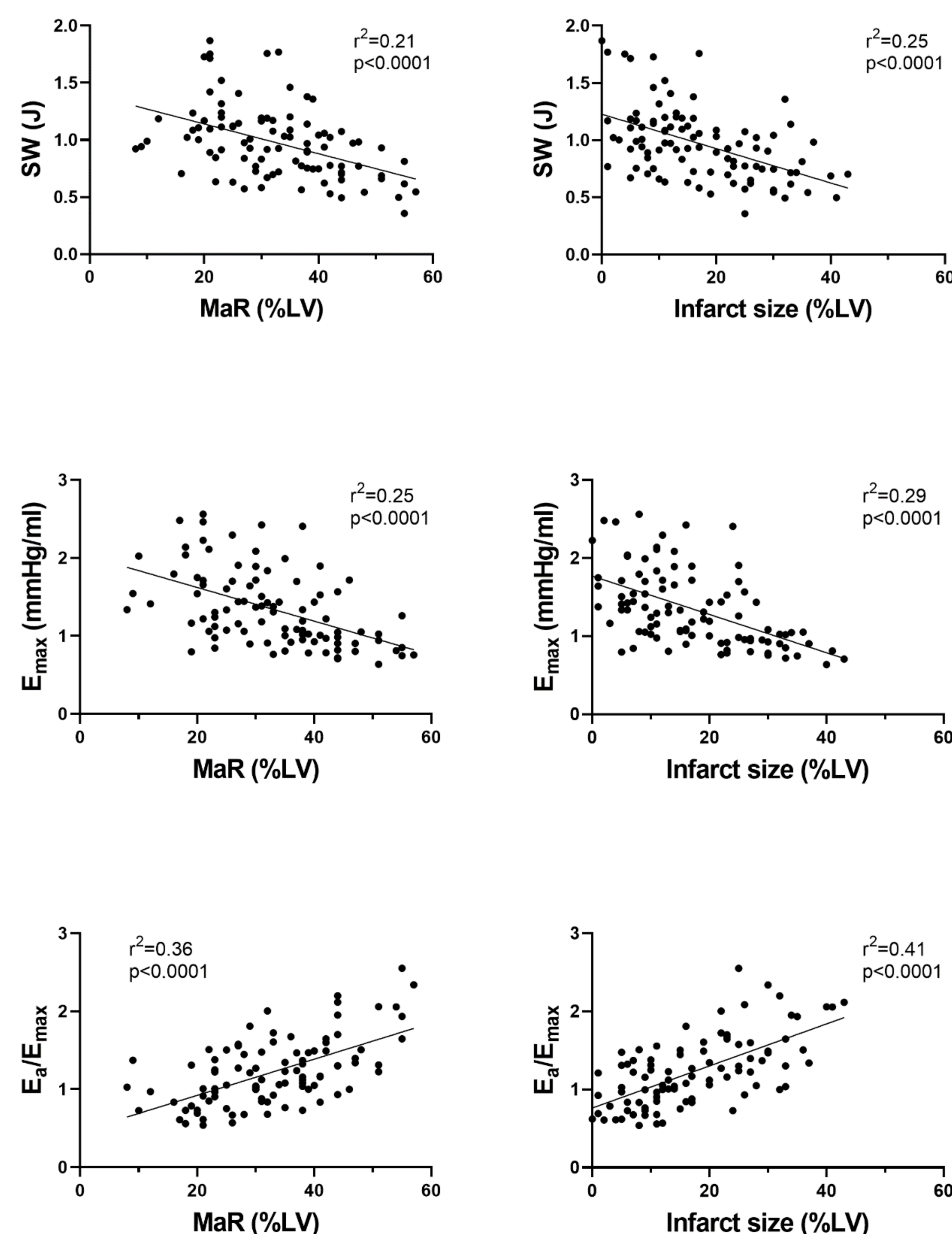


Figure 2. Stroke work, contractility and ventriculoarterial coupling versus myocardium at risk (left column) and infarct size (right column).

Conclusion

Non-invasive cardiovascular magnetic resonance derived PV-loop variables such as contractility, stroke work and ventriculoarterial coupling provide incremental diagnostic information beyond cardiac dimensions and ejection fraction early after acute myocardial infarction.

References

- (1) Seemann et al. Circ Cardiovasc Imaging 2019;12(1)