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 (Emax = contractility), stroke work and ventriculoarterial coupling (Ea/Emax) 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

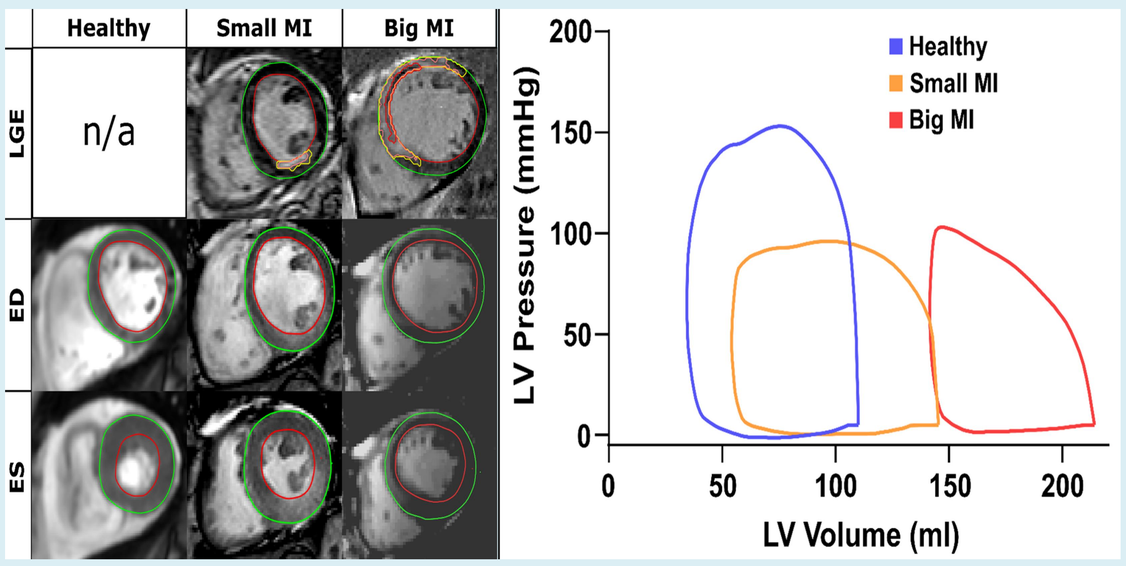

Figure 1. Example of PV-loops in patients with myocardial infarction.

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 (Emax: r^2=0.29, Ea/Emax: r^2=0.41, stroke work: r^2=0.25) and myocardium at risk (Emax: r^2=0.25, Ea/Emax: r^2=0.36, stroke work: r^2=0.21) as shown in **Figure 2**.

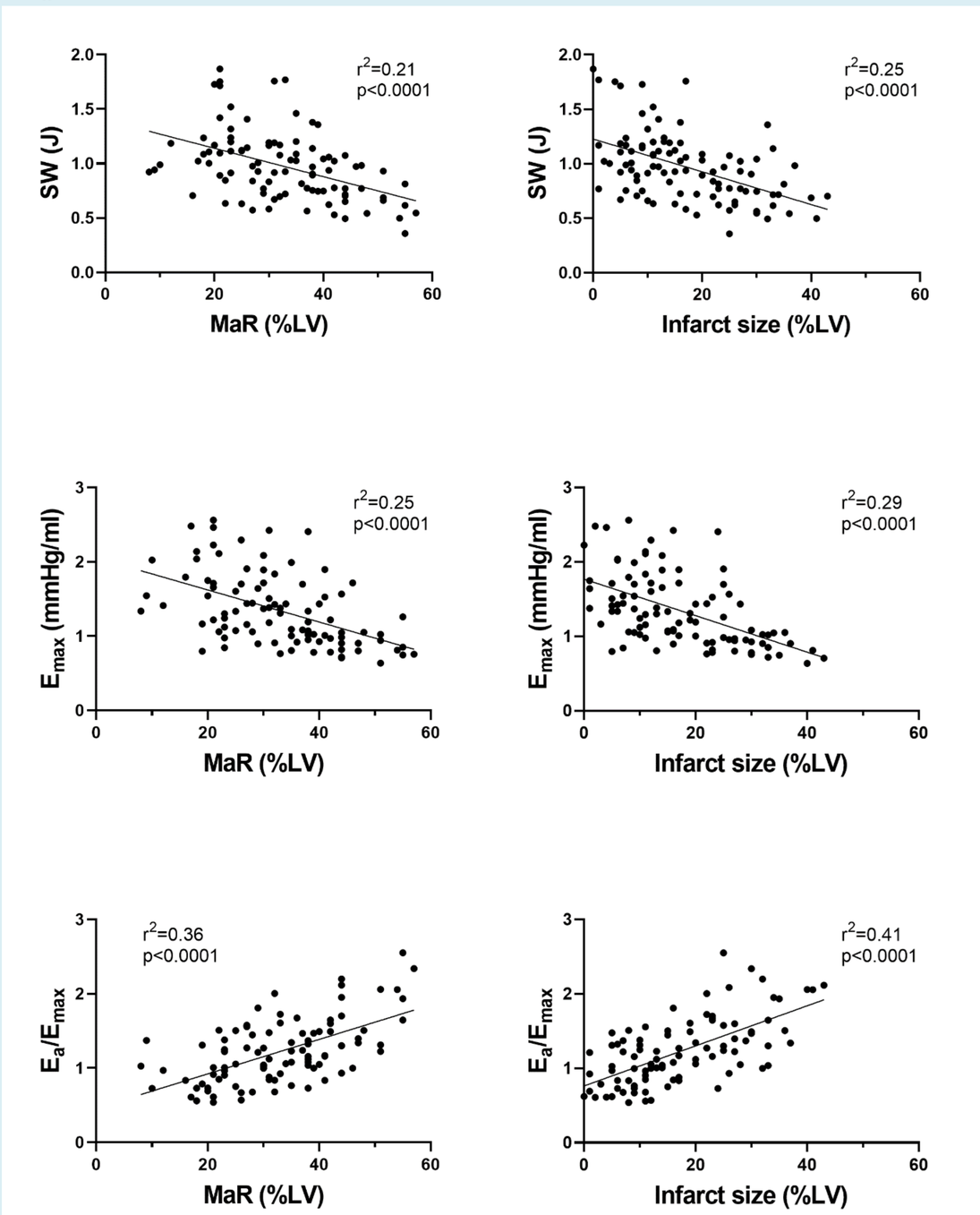

Figure 2. Stroke work, contractility and ventriculoarterial coupling versus myocardium at risk (left column) and infarct size (right column).

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)

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