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P25 Effect of Live-firefighting on Ventricular-vascular Coupling

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ABSTRACT

Introduction: Cardiovascular events are the leading cause of death among firefighters, with the greatest risk occurring during or shortly after fire suppression activity. Increased cardiovascular risk potentially manifests from detrimental changes in ventricular function, vascular load, and their interaction described as ventricular-vascular coupling (VVC). Therefore, our objective was to determine the effect of live-firefighting on ventricular systolic function, vascular load, and VVC.

Methods: Forty male (27 ± 6 years, 26.9 ± 4.0 $kg \cdot m^{-2}$) firefighters completed hemodynamic and cardiac measures before and 10–30 minutes after 3 hours of live-firefighting. Left ventricular function assessed as ejection fraction (EF), fractional shortening (FS), and ventricular elastance (Elv: ESP/end-systolic volume [ESV]) via echocardiography and brachial-estimated ESP. Vascular load assessed as arterial elastance (Ea: end systolic pressure [ESP]/stroke volume [SV]). VVC quantified as the ratio of Ea to Elv and indexed to body surface area (EaI, ElvI).

Results: Following firefighting, both EF and FS significantly decreased ($p < 0.05$) with no change in Elv ($p = 0.49$) EaI significantly increased ($p < 0.01$), driven by EDV-mediated decreases in SV ($p < 0.05$) and unaltered ESP ($p = 0.99$). These disparate changes resulted in an increase in VVC ($p < 0.01$) post firefighting.

Conclusion: Our findings suggest firefighting does not alter ventricular elastance but increases arterial load among healthy firefighters; resulting in an uncoupling of the heart and vascular systems. This undesirable increase in VVC and concomitant reduction in ventricular systolic function may contribute to increased cardiovascular risk following firefighting.

Changes in cardiovascular parameters pre/post firefighting activity

	Pre	Post	*p*
Weight* (kg)	88.9 ± 14.0	88.0 ± 14.0	**<0.001**
SBP (mmHg)	135 ± 16	135 ± 16	0.992
DBP (mmHg)	80 ± 8	80 ± 10	0.868
MAP (mmHg)	98 ± 7	98 ± 10	0.868
HR (bpm)	70 ± 11	90 ± 13	**<0.001**
SV (ml)	84.7 ± 20.1	71.1 ± 21.8	**<0.001**
EDV (ml)	144.1 ± 37.0	132.3 ± 37.9	**0.003**
ESV* (ml)	59.3 ± 24.6	61.2 ± 24.5	0.506
ESP (mmHg/ml)	121.3 ± 8.0	121.3 ± 14.2	0.992
EF (%)	59.7 ± 9.2	54.3 ± 9.4	**0.004**
FS (%)	32.6 ± 6.3	28.6 ± 6.0	**0.002**
EaI*	0.73 ± 0.46	1.89 ± 0.67	**0.001**
ElvI*	1.15 ± 0.53	1.12 ± 0.58	0.487
VVC*	0.72 ± 0.30	0.91 ± 0.48	**0.002**

*p-value obtained from transformed variable. SBP, systolic blood pressure; DBP, diastolic blood pressure; MAP, mean arterial pressure; HR, heart rate; SV, stroke volume; EDV, end diastolic volume; ESV, end systolic volume; ESP, end systolic pressure; EF, ejection fraction; FS, fractional shortening; EaI, arterial elastance indexed to body surface area; ElvI, ventricular elastance indexed to body surface area; VVC, ventricular-vascular coupling.

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