

MP5-3

A chronic preload reduction animal (ovine) model : acute effects of reloading

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Introduction : Many cardiac conditions cause chronic volume deprivation of the systemic ventricle (e.g. Fontan, mitral stenosis, PAH, large ASD). We created a chronic volume deprived ventricle in an animal model (ovine) to study the effects of chronic volume deprivation and acute reloading.

Methods : in lambs a tight PTFE strip was placed around the inferior and superior caval vein through thoracotomy (n=14). Ten months later the PTFE bands were percutaneously dilated. Cardiac MRI was performed prior and within 48 h after debanding, hemodynamic data and PV loops (CD Leycom) were recorded prior and immediately (30 min) after debanding. Histology was done. Data was compared to age and weight matched healthy controls (n=9).

Results :

1/ Survival: 2 animals died after banding (ascites), 2 after debanding (rupture IVC).

2/ Acute hemodynamic effects (PV loop): baseline EDP is elevated 9.0 ± 3.3 mmHg compared to normals 1.0 ± 3.4 mmHg ($P < 0.05$). EDP rises after debanding to 12.4 ± 4.0 mmHg ($P < 0.05$). The left ventricular CO is 3.3 ± 0.7 pre and 3.0 ± 0.6 L/min post debanding, compared to 3.0 ± 1.2 L/min in normal animals. The EDV is 70.2 ± 8.7 pre and increases to 81.9 ± 13.5 ml post debanding ($p < 0.05$), compared to 85 ± 7.2 ml for normal animals. The ESV rises from 33.2 ± 5.4 to 44.5 ± 11.3 ml after debanding (55.6 ± 18.4 ml in normal). Heart rate rises from 88 ± 9 to 101 ± 15 BPM compared to 94 ± 7 BPM in controls.

3/ Effect after 48 h (MRI): EDV on MRI is 70.5 ± 7.7 ml before and 64.2 ± 10.5 ml 48 h after debanding ($P 0.79$) ESV is 33.1 ± 5.0 before and 34.1 ± 11.3 ml 48 h later ($P 0.14$) EDV in healthy controls 76.1 ± 14.1 ml and ESV 41.2 ± 7.7 ml. 62.2 ± 10.5 ml.

4/Histology: mean mass RV 29.2 ± 4.4 g, LV 93.1 ± 16.6 g was not significantly different from healthy controls; mean number of transected myocytes per 0.5 mm was RV 16.2 ± 2.2 and LV 16.4 ± 1.9 , no signs of fibrosis.

Conclusion : In a chronic volume deprived ventricle the end diastolic pressure is elevated without marked histologic changes; EDP acutely rises when restoring the preload. Better understanding of this phenomenon may help avoiding/treating decreased ventricular compliance.

