EFFECTS OF AFTERLOAD AUGMENTATION ON CARDIAC PERFORMANCE ARE NOT BAROREFLEX MEDIATED

P. Kohl, B. Lambermont, V. D’Ortis, P. Gerard, A. Ghysen, and R. Linet

Background: This study aimed at evaluating left ventricular (LV) response to afterload augmentation. Furthermore, to assess baroreflex intervention, we compared the effects of afterload increase on the intact cardiovascular system and under hemoxenation infusion.

Methods: Six open-chest pigs, instrumented for measurement of aortic pressure and flow, LV pressure and volume, were studied under pentobarbital-isoflurane anesthesia. Vascular properties [characteristic impedance (Ri), peripheral resistance (Rp), compliance (Cc), arterial elastance (Ea)] were estimated with a windkessel model. LV function was assessed by the slope (Ea) of end-systolic pressure-volume relationship (ESPVR) and stroke work (SW). Ventriculoarterial coupling was defined as E/Em and mechanical efficiency as SW/pressure-volume area (PVA). After baseline recordings, LV afterload was increased by means of an aortic occlusion. Hemodynamic measurements were obtained every 30 minutes. The occlusion was then lifted, and after 30 minutes of rest, the spontaneous nervous system was inhibited by continuous infusion of atrioneuramine and hemoxenation. The occlusion was reinstalled, and hemodynamic measurements repeated every 30 minutes later. Results are presented as mean ± SEM.

Results: While aortic coarctation increased arterial pressure from 10.2 ± 0.10 to 119 ± 0.07 mmHg (p < 0.001) and decreased Cc from 0.57 ± 0.04 to 0.4 ± 0.05 mmHg/ml (p < 0.005) independently of hemoxenation infusion, Ri and heart rate increased (from 1.50 ± 0.11 to 1.70 ± 0.06 mmHg/sec/ml and from 115 ± 5 to 125 ± 2 beats/min, respectively; p < 0.05) only when the spontaneous nervous system was intact. Independently of hemoxenation infusion, E/Em increased from 2.95 ± 0.18 to 3.17 ± 0.05 mmHg/ml, and while dead volume V̄ decreased from 5.3 ± 0.2 to 4.7 ± 0.3 ml (p < 0.01). E/Em was normalized at 1.34 ± 0.14 at baseline (p < 0.05) with coarctation; NS in both conditions. At matched end-diastolic volumes and independence of baroreflex integrity, SW and PVA increased (from 12.2 ± 1.68 to 21.2 ± 1.14 mmHg/ml and from 2.87 ± 0.22 to 5.25 ± 0.22 mmHg/ml, respectively; p < 0.005) and SW/PVA decreased from 0.70 ± 0.12 to 0.64 ± 0.10 (p < 0.05).

Conclusions: Our results demonstrate that an augmentation in afterload has a composite effect on LV function. Ventricular performance is increased, as demonstrated by ESPVR leftward shift, increased E/Em and SW, but the efficiency of the energetic transfer from PVA to external mechanical work is reduced. These changes are observed independently of baroreflex integrity.

Haemodynamic Research Center, University of Liège, Liège 4000, Belgium

ECHOCARDIOGRAPHIC EVALUATION OF CARDIAC PERFORMANCE DURING SIMULATION WITH DOBUTAMINE IN CONSCIOUS HORSES: A PRELIMINARY STUDY

C. Sanderson, C. Delugele, M. Becker, M. Debrus, H. Guyot, H. Amory

Dobutamine stress echocardiography is a routine procedure in human medicine to determine cardiac pumping reserve (CPR), to detect sub-clinical cardiac diseases and to determine their prognosis. The aim of this study was to evaluate cardiovascular response to a dobutamine stress test in conscious horses in order to evaluate the feasibility of this method to determine CPR in equine medicine. Six horses with an average age of 13 years (range: 6–21 years) and a mean weight of 495 ± 61.96 kg (range 455 to 575 kg) were used. The velocity time integral (VTI) of the aortic flow and the aortic diameter were measured by means of a 2.5MHz probe for 40 sec, capable of pulsed wave Doppler analysis. Systemic arterial pressure (SAP) was measured non-invasively using a cuff placed around the tail. Heart rate (HR) was calculated from simultaneously recorded ECG tracings. Stroke index (SI), cardiac index (CI) and cardiac power output (CPO) were calculated from the measured parameters. Measurements were performed at rest and repeated under dobutamine infusion that raised from 2μg/kg/min in steps of 1μg/kg/min every 5 minutes. Criteria to stop the test were: no further increase in HR, VTI and SAP or an adverse reaction of the horse, sustained premature ventricular complexes (PVC) or a sudden rise in HR or SAP.

In all horses, the dobutamine infusion had to be interrupted before the end of the test because of a severe increase in SAP (200 mmHg) associated with dyspnea and obvious discomfort of the animal. The maximal dose of dobutamine was reached from 5 to 7 μg/kg/min. At this dose, HR, VTI, SI, CI and PT were显著ly different from resting values, while SAP and CPO were significantly increased. The mean percentage of increase in CPO at 2.5, 4.5, and 6.5 μg/kg/min was 24.99% ± 17.62 (SD), 57.34% ± 19.08 (SD), 80.81% ± 42.73 (SD) and 136.19 ± 78.70 (SD), respectively. This study demonstrated that dobutamine incremental challenge in conscious horses induces a severe systemic hypertension which limits its use to measure the cardiac pumping reserve.