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EFFECTS OF AFTERLOAD AUGMENTATION ON CARDIAC PERFORMANCE ARE NOT BAROREFLEX MEDIATED

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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 cardio-vascular system and under hexamethonium infusion.

Methods: Six open-chest pigs, instrumented for measurement of aortic pressure and flow, LV pressure and volume, were studied under pentobarbital-sufentanil anaesthesia. Vascular properties [characteristic impedance (R_1), peripheral resistance (R_2), compliance (C), arterial elastance (E_a)] were estimated with a windkessel model. LV function was assessed by the slope (E_{es}) of end-systolic pressure-volume relationship (ESPVR) and stroke work (SW). Ventriculo-arterial coupling was defined as E_{es}/E_a, and mechanical efficiency as SW/pressure-volume area (PVA). After baseline recordings, LV afterload was increased by means of an aortic coarctation. Haemodynamic measures were obtained after 30 minutes. The coarctation was then lifted, and after 30 minutes of rest, the autonomous nervous system was inhibited by continuous infusion of atropine and hexamethonium. The coarctation was reinstalled, and haemodynamic measurements repeated 30 minutes later. Results are presented as mean ± SEM.

Results: While aortic coarctation increased R_1 (from 0.132 ± 0.010 to 0.352 ± 0.007 mmHg.sec/ml; $p<0.001$) and decreased C (from 0.57 ± 0.04 to 0.41 ± 0.05 ml/mmHg; $p<0.005$) independently of hexamethonium infusion, R_2 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 autonomous nervous system was intact. Independently of hexamethonium infusion, E_{es} increased from 2.81 ± 0.18 to 3.69 ± 0.20 mmHg/ml, while dead volume V_d decreased from −3.6 ± 0.2 to −6.8 ± 0.3 ml ($p<0.01$). E_{es}/E_a remained unchanged (0.84 ± 0.14 at baseline, 0.81 ± 0.11 with coarctation; NS) in both conditions. At matched end-diastolic volumes and independently of baroreflex integrity, SW and PVA increased (from 2012 ± 168 to 2912 ± 114 mmHg.ml and from 2874 ± 352 to 4520 ± 224 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_{es} 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.

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

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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 age of 19.6 ± 3.14 (SD) years (range 16 to 23 years) and a mean weight of 495 ± 61.96 (SD) 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 sector probe, capable of pulsed wave Doppler analysis. Systolic 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 raise 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 (>300 mmHg) associated with dyspnoea and obvious discomfort of the animal. The maximal dose of dobutamine was reached ranged from 5 to 7 µg/kg/min. At this dose, HR, VTI, SI, and CI were not significantly different from resting values, while SAP and CPO were significantly increased. The mean percentage of increase in CPO at 2,3,4,5 µg/kg/min was 24.99% ± 17.622 (SD), 57.34% ± 19.08 (SD), 80.81% ± 42.42(SD) and 138.19 ± 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 cardia pumping reserve.

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THE SEVERITY OF COLIFORM MASTITIS AND INOCULUM SIZE

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Mastitis is economically the most important disease in dairy cows. The incidence of acute coliform mastitis is highest between parturition and peak lactation. A large variation in severity of clinical signs is due to the susceptibility of individual cows, whereas inoculum dose seems to be unimportant. The aim of this study was to evaluate the effect of higher inoculum doses on the inflammatory reaction following intramammary infusion of *E. coli* in early-lactating heifers with low SCC. Therefore, 29 clinically healthy lactating heifers (21 ± 3 days in lactation) were selected and infused intramammarily in the front and rear left quarters with either 10^4 (low dose; n = 14) or 10^6 cfu (high dose; n = 15). Blood and milk samples were collected on -96, -24, 24, 48, 72h and every 3h on the day of infusion. Clinical examination was performed each time blood and milk samples were taken. Somatic cell count, colony forming units (cfu) and blood leukocytes (BL) were assessed. The decrease in quarter milk production of the uninfected quarters 48h post-infusion (p.i.) has been used to classify the cows into moderate and severe responders. All heifers reacted as moderate responders. A significant interaction between inoculum size and time ($P = 0.0001$) was observed, so that it can be concluded that milk production behaves differently over time when the inoculum size differs. In the high dose infusion group, SCC rapidly increased above 10^6 cells/ml from 6h p.i. onwards, whereas in the low dose infusion group this only happened around 9h p.i. A significant interaction ($P < 0.006$) between time and inoculum size was observed for the bacterial population. The cfu already reached its maximum at 3h p.i. in the high dose infusion group, whereas peak cfu in the low dose infusion group was only observed at 6h p.i. Blood leukocytes showed a significant interaction ($P < 0.036$) between time and inoculum size. In the high dose infusion group, BL decrease to a minimum within 9h p.i., followed by a rapid recorvery at 48h p.i. It can be concluded that the inoculum dose is not a decisive factor for the severity of coliform mastitis in heifers with a low SCC. Nevertheless, the lag-time between the infusion of *E. coli* bacteria and the occurrence of clinical symptoms differed between the infusion groups. In the high dose infusion group, clinical symptoms occurred approximately 3h earlier in comparison to the low dose infusion group. The alteration of the clinical parameters in heifers were similar to multiparous cows after intramammary infusion of *E. coli*. However, based on the milk production of the uninfected quarters, no severe responders were observed in our study. This can partly be explained through the fact that the impairment of neutrophil function seems to be more severe for cows with parity ≥ 4 than for younger cows and especially heifers.

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L-SELECTIN EXPRESSION INCREASES STRONGLY UPON MATURATION OF BOVINE PROGENITOR CELLS

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During infection, polymorphonuclear neutrophil leukocytes (PMN) are the first cells recruited, and PMN adhesion receptors are responsible for rolling and attachment of the cell to the endothelium. Evidence in humans has been shown of the L-selectin role during PMN release from the hematopoietic compartment into the venous sinusoids of the bone marrow (BM), and of a rise on peripheral blood band cells. Until now, cellular immune functions were studied only on late stages maturation of bovine BM PMN, and L-selectin expression on bovine BM cells was not assessed yet. The objective of this study was to evaluate L-selectin expression at all stages of PMN progenitors maturation, and compare it to blood PMNs. Nine cows were used. Bone marrow cells were collected from the sternum and isolated by centrifugation on an optimized discontinuous Percoll gradient, resulting in three maturation-related fractions (early, late and mature granulocytic cells). Blood cells were collected and also centrifuged on a density gradient, yielding in pure PMN suspensions. L-selectin surface expression was carried out through indirect labeling. Results show 1.98% (±0.14) of early immature cells expressing L-selectin. This parameter reaches 4.86% (±0.35) in late immature, and 51.28% (±3.34) in mature cells. 74.09% (+3.72) of blood PMN expresses L-selectin. Mean Fluorescence Intensity (MFI) of the receptor was respectively in the different maturation stages 20.3 (±1.38), 21.11 (±1.60), and 25.89 (±2.55). MFI was 20.75 (±1.67) in blood. The results were confirmed by fluorescence microscopy. Our data show that all bovine BM cells express L-selectins, and provide indication over the capacity of cells at different stages of maturation to deplete from the bone marrow storage pool to the marginal pool and eventually react to the inflammatory stimuli.

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