

Tissue Doppler imaging - A pilot trial in horses

7. Summary

Traditional diagnostics mainly used Doppler echocardiography for the fast identification of direction, velocity, intensity and characteristic of blood flows. Recent devices offer the possibility of visualising the myocardium regarding direction and velocity of movement using the Doppler principle.

In collaboration with human medicine, the present pilot trial compared the velocity profiles of the myocardium determined in horses to those of the human being and of the pig (DERUMEAUX 1998; STROTHMANN 2002a; TRAMBALIOLO 2002). The study aimed at an identification of the characteristic of the curve in horses. In addition, the possibility of an application of the various versions of tissue Dopplers (pulsed wave Doppler and colour-coded tissue Doppler) for cardiac diseases of horses should be examined.

In all, 42 warmblood horses were examined echocardiographically using the system FiVe of the company GE Healthcare. The subjects were divided into the following groups: horses with multiple valvular insufficiencies without dilatation of the atrium and / or ventricle (n = 9), horses with multiple valvular insufficiencies with dilatation of the atrium and / or ventricle (n = 8), horses with aortic valve insufficiency without dilatation of the atrium and / or ventricle (n = 3), horses with aortic valve insufficiency with dilatation of the atrium and / or ventricle (n = 4). Horses showing atrial fibrillation during the clinical examination formed another group (n = 8). This group was not further divided by degree of dilatation or occurrence of valvular insufficiency.

All horses underwent a tissue Doppler examination using pulsed wave Doppler and colour-coded tissue-Doppler in addition to usual echocardiography. The images were taken in right caudal short axis. In the spectral Doppler, the sample volume was positioned on the one hand into the myocardium of the left-ventricular posterior wall and on the other hand into the interventricular septal myocardium. At least 3 consecutive cardiac cycles were saved using digital technology. The data of the colour-coded tissue Doppler could be post-processed off-line using a special software. On the basis of a simultaneously led ECG, the myocardial velocities in defined stages of the cardiac cycle were measured.

For the first time, the velocity profiles typical in human beings could be visualised repeatably in a similar way in horses. At the left-ventricular posterior wall, the velocities of the isovolumetric contraction, the peak systolic velocity, the early diastolic and late diastolic contraction velocity were measured using the curve progression. The measuring point of the isovolumetric relaxation could not be determined clearly. The isovolumetric contraction and relaxation could not be identified at the interventricular septum.

In the group of horses with aortic valve insufficiency, both procedures showed a significant increase of the peak systolic velocities at the interventricular septum.

In horses with atrial fibrillation, the A waves of late diastolic contraction were missing at both measuring points and in both procedures. The velocity of isovolumetric contraction of the left-ventricular posterior wall is significantly increased for both tissue Doppler procedures. The level of significance was fixed at $p < 0,05$.

The application of tissue Doppler echocardiography in equine medicine is generally possible. The results may allow the procedure to be used as prognostic method in the follow-up of patients suffering from atrial arrhythmia and aortic valve insufficiencies. For this, further systematic examinations over a longer period are necessary.