

New methods for long-term measuring of animal welfare: Preliminary results of implantable ECG logger

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There is a need to develop new methods for long-term monitoring of animals' welfare. Many studies on different species, including cattle, show that heart rate variability (HRV) is a promising stress indicator. However measuring HRV has been dependent on ECG monitors placed on the skin and these monitors do not function properly with animals and can be used only for short periods of time. Our aim was to test a new implantable long-term ECG and activity logger for dairy cattle.

Lithium-battery powered implants were able to record ECG, acceleration and temperature data continuously and store the measured data on a secure digital (SD) memory card, with sample rates of 341.3 Hz, 16Hz and 0.0625 Hz respectively. Implants were covered with layers of medical grade, EPO-TEK 301-2FL, epoxy and biocompatible parylene C.

The implants were placed on the left side of the cow into a pocket made between the skin and subcutaneous tissue. Two weeks after the surgery the cows were exposed to physical stress, i.e. 500 m walk outside twice a day for a week.

Eight out of 12 implants collected data and the operation time was 15 to 17 days. The quality of collected ECG-signal was good and plenty of 5 minute intervals, required for spectral analyses, were easily obtained.

The device collected data also during physical exercise, and the data were interpretable. This is a clear improvement as compared to our previous surface ECG measurements. However, comparison of ECG data to accelerometer signals showed that during acceleration peaks ECG signal had higher noise level.

In conclusion, the implant could provide a simple tool for long-term monitoring of HRV and animal welfare.

