Evaluation of Information Obtained from a Series of Blood Samples from Stress-Free Roaming Cattle Taken with the Aid of Radio Remote Controlled Small Portable Blood (or Other Body Fluids) Sampling Devices

E. Stephan
M. Cybik
Department of Animal Management and Protection
Veterinary University of Hannover
D-3000, Hannover
Federal Republic of Germany

Introduction

It is compulsory to obtain unaltered fluid samples for laboratory analysis in order to obtain a valid diagnosis in medicine, as well as in other fields. Sampling techniques like puncture, catheterization, tubing and other methods are important for the usefulness of the samples. Dull needles, rigid catheters, a vacuum that is too strong during aspirations of the samples, as well as insufficient treatment of the skin lesions may cause problems, especially when samples have to be drawn repeatedly or over a long period of time. This may be overcome by the use of proper instruments and skill.

Further difficulties which may reduce the value of the laboratory analysis are the psychological effects of stress, forced submission, pain and possibly even of approaching the probationer/patient. This may also be overcome by suitable means (blinds etc.), quiet manipulation under cover and skill.

The sampling of body fluids from mobile animals and people (e.g. for the evaluation of the effects of work and training in veterinary-, rehabilitation, flight- and sports medicine) is especially difficult. Even though it might be possible to stop the probationer/patient for a short time during motion in order to obtain samples, it cannot be excluded that these interruptions of the motion may alter the results of the analysis when compared to an uninterrupted motion. Even greater deviations from the correct values are caused by sampling following a motion or exercise. Other parameters such as the plasma concentrations of glucose and corticosteroids are altered compared to the initial value before exercise, depending on the time of sampling.

This well known problem caused difficulties in blood sampling during a project which studied the effects of aircraft (jets and helicopters) flying at low altitudes over stationary and free-roaming animals.

Materials and Methods

Investigations on the problem of automatic blood sampling were started in Giessen in the early sixties, leading to the development of a monitoring device which is fixed on the probationer/patient without inconvenience so that samples of body fluids (e.g. blood, urine, and rumen fluid) are drawn automatically at desired times. The samples are stored within the device and the tube which connects body and device is cleaned automatically by appropriate fluids, thus preventing cross contamination between different samples. (A technical quality-control which involved the drawing and storing of half of the volume of 10 blood samples, which were manually drawn, showed no significant changes of the blood due to the device.

At present the device consists of two parts: 1) The sampling and storing part, approx. 220 × 165 × 55 mm (H × W × D), and 2) The monitoring and supply part, approx. 80 × 165 × 55 mm (H × W × D). The programming part and the emitter are separated.

The store within the sampling and storing part can hold up to 10 samples in tubes of 5 or 10 ml volume. It is possible to replace some of the tubes and to install a limited cooling mass instead. This is necessary for some analyses; e.g., catecholamines. This part is connected by tube and flexible permanent needle with arteries, veins, rumen, urine-bladder or other fluid-containing parts of the body.

Monitoring may be done be pressing a button on the device itself (for example by a rider), by remote radio control or by built-in timer. The device is removed from its bag after the required amount of samples has been drawn

Paper presented at the XV World Congress on Cattle Diseases, Palma de Mallorca, Spain; October 10–16, 1988.

and the store containing the tubes is removed. The entire tube system can be cleaned, disinfected and rinsed with the aid of a built-in rinsing program.*

The investigations dealt with in this paper were carried out with a total of 40 pregnant cows of the German Black and White breed under the low altitude overflights of different jet and helicopter aircraft.

The blood samples drawn from the jugular veins without any person close to the animals were removed out of the storing parts of the devices and analyzed in the laboratory in respect of the reproduction relevant hormones progesterone and 17-estrogen as well as of the total plasma corticosteroids.

Results and Discussion

Due to limited space, only an example will be given about the alterations of the plasma corticosteroid levels which were induced by the acoustic, optical, tactile and maybe olfactoric stimuli emitted by the overflying aircraft (Figures 1–3).

The total plasma corticosteroid levels, calculated as the average values of the animals No. B 1–10 at different times of three days without any scheduled fluctuations. Only on day 3 there is a maximum of about 6 $ng.ml^{-1}$, maybe induced by one or several unscheduled overflights by foreign aircraft in spite of effective flight prohibitions.

Figure 2 demonstrates that total plasma corticosteroid level alterations can depend on the type of overflying aircraft. The fast flying jet aircraft emit very strong but very short acoustic and optical stimuli (Alpha-Jet: until 109,5 dB (A), until 3.5 sec; F 104g Starfighter: until 118,0 dB (A), until 2.0 sec), whereas slower flying or even hovering helicopters emit longer lasting stimuli (Bell UH 1 D: until 99,0 dB (A), until 180 sec when hovering. In that way the corticosteroid levels, induced by the helicopters, increased until more than 7 $ng.ml^{-1}$.

There are also individual differences (Fig. 3). Animal No. 15 and animal No. 20 both react quite fast on the overflight stimuli with maxima at times 4 and 5 respectively time 5, but the maxima of animal No. 15 may lower (about 6 $ng.ml^{-1}$) as those of animal No. 20 (more than 10 $ng.ml^{-1}$) do. Another type of reaction is seen with animal No. 18. Here a quite strong (more than 10 ng.ml-1) but quite short increase of these levels at time 4 (15 min after the end of the overflights) whereas the levels before and after time 4 are completely normal.

So, the alterations of the total plasma corticosteroid levels of the pregnant cows, used in these investigations, were not only dependent on the type of stimuli emitted by the different aircraft, but also on the individual animals. There was no influence of the stage of pregnancy of the animals.

Summary

The procedure of sampling blood and other body fluids can produce a psychic strain in the probationer/patient, which might alter the analytical results. Besides, drawing samples from mobile probationers/patients in rehabilitation-, sports-, aviation-, and veterinary medicine is limited, as the necessary interruption of motion might alter the values to be measured.

By use of radio remote and/or time controlled small portable devices, it is possible to take fluid samples even under difficult conditio (ients in training or pilots under extreme flight situations or unrestrained free roaming animals.

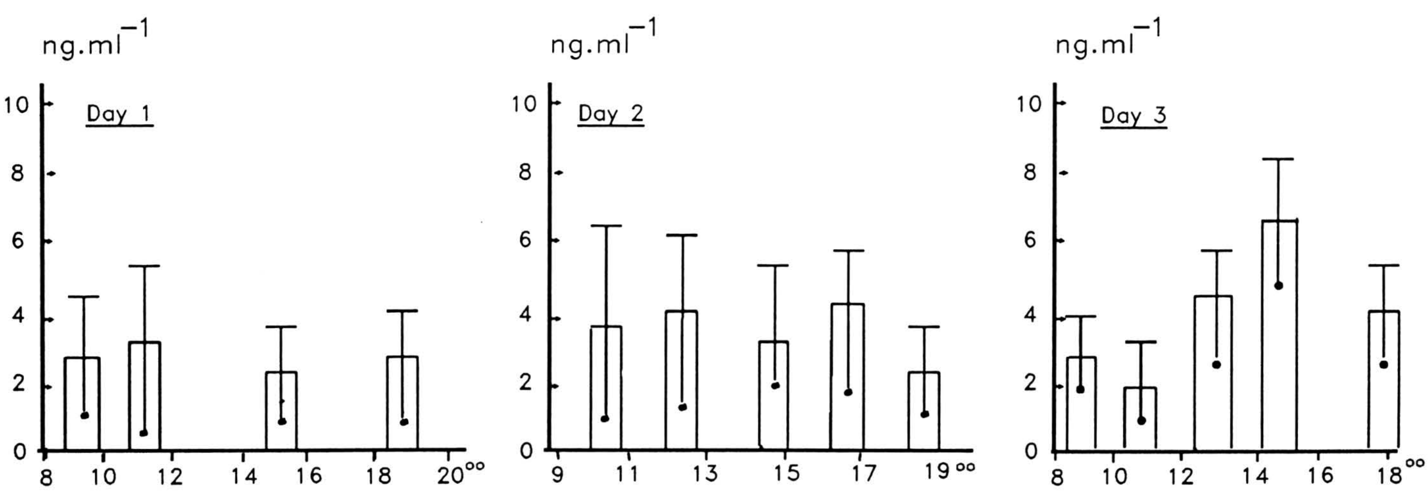

FIGURE 1. Total plasma corticosteroids (in $ng.ml^{-1}$). Average of animals No. B 1–10 at different times of the days 1–3 (without scheduled overflights).[1]

Manufactuerer: Fa.KLEINFELD, Leisewitzstr. 47, D-3000 Hannover 1, (FRG).

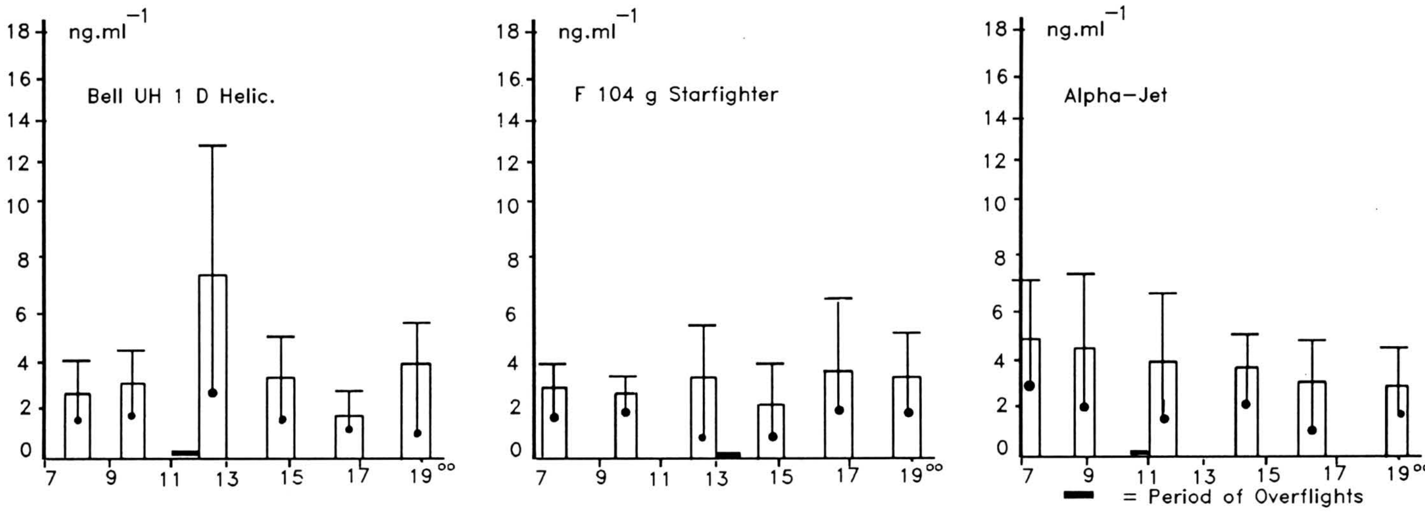

FIGURE 2. Total plasma corticosteroids (in ng.ml^{-1}. Average of animals No. B 1—10 at different times of the days and different types of overflying aircraft.[1] Period of overflights has been marked.

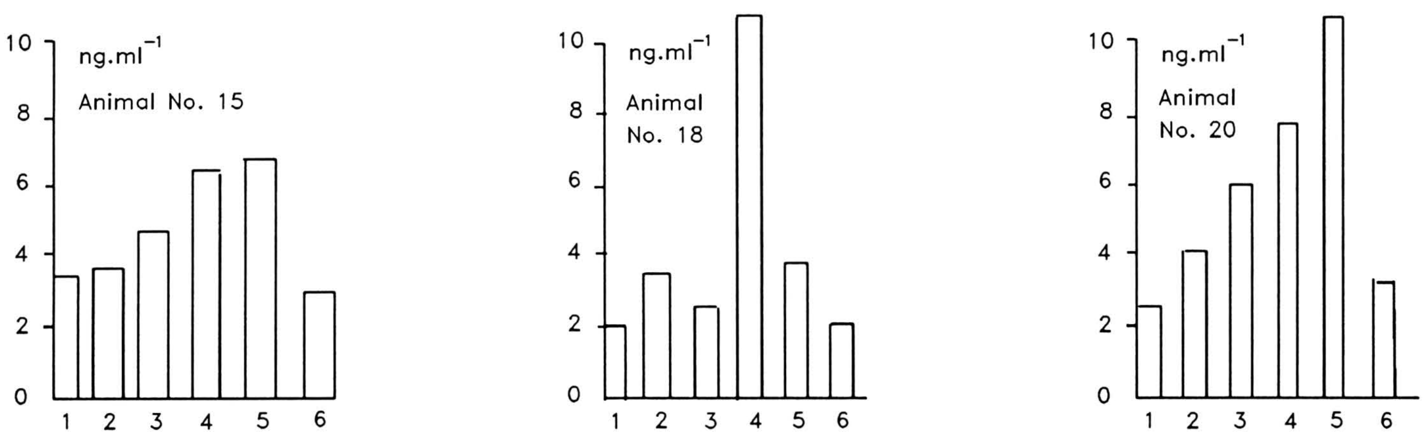

FIGURE 3. Total plasma corticosteroids (in ng.ml^{-1}). Animals No. C 15, 18 and 20. Average of the relevant animal at different times of all days with overflights.[2]

Time 1 : 2.5 h before beginnning of the overflights
2 : 8 min after beginning of the overflights
3 : 23 min after beginning of the overflights
4 : 15 min after end of the overflights
5 : 2.0 h after end of the overflights
6 : 6.0 h after end of the overflights

In this manner, blood samples of 40 pregnant cows in the course of the day, and before, during and after low altitude overflights of different types of jet and helicopter aircraft were taken and analyzed in the laboratory.

There were very strong differences in the induced increasing of the blood plasma corticosteroid levels, dependent on the individual animals and on the types of aircraft.

References

1. Beyer, D. Untersuchungen uber die Auswirkung tieffliegender Flugzeuge auf endokrinologische und physiologische Parameter bei tragenden Rindern. Inaugural-Dissertation, Tierärztliche Hochschule Hannover, 1983. 2. Heicks, H. Untersuchungen über den Einfluß von Fluglärm auf in einem Offenstall angebundene trächtige Rinder. Inaugural-Dissertation, Tierärztliche Hochschule Hannover, 1985.