# CYTOGENETIC DOSIMETRY OF RADIATION DAMAGES IN DOMESTIC ANIMALS

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## ABSTRACT

In case of mass radiation of people and animals the estimation of radiation dose is the basic prerequisite for undertaking protection measures and the triage of radiated individuals. In the early phase of the accident, estimation of radiation dose in animals only on the base of the physical dosimetry is often deficient and unreliable.

In this paper a possibility of using biodosimetric methods for estimation of absorbed radiation doses in domestic animals in case of an accident is discussed. For this purpose radiation of full animal blood with 6 different radiation doses was carried out. After the blood radiation, preparation and cultivation of lymphocytes as well as a certain number of specific chromosomal aberrations for each radiation dose were performed. The obtained results indicate that the number of specific chromosomal aberrations increases with the increase of radiation dose.

## INTRODUCTION

It is necessary to know radiation doses in the first phase of an accident to be able to carry out protection measures effectively in case of radiation emergency (1). Estimation and measuring of exposure doses can successfully be performed by using physical methods of ionizing radiation dosimetry. However, from the aspect of the biological effect on live organisms, it is necessary to know the absorbed radiation dose in the tissue of each individual (2-4). Physical dosimetry methods can not be applied for measuring of the absorbed dose of ionizing radiation in case of an accident. This particularly refers to the estimation and establishing of the absorbed radiation dose in domestic animals and people, on the basis of which it is possible to estimate the level of radiation damage and to undertake further protection measures. Because of this, the aim of this investigation was to determine the level of radiation damage in pigs on the basis of cytogenetic methods of ionizing radiation dosimetry.

## MATERIAL AND METHODS

The blood of healthy pigs, in which the number of spontaneous chromosomal aberrations was previously determined, was irradiated with 6 different doses of high-energy-X-rays (0.1; 0.2; 0.5; 1.0; 2.0 and 3.0 Gy). After irradiation, lymphocyte preparation and cultivation according to the modified method of Morhed were performed and the number of specific chromosomal aberrations dicentric and ringlike chromosomes) determined. The analysis of the number of chromosomal aberrations was carried out on at least 1000 good visible metaphase figures for each radiation dose.

## RESULTS AND DISCUSSION

In the blood of healthy unexposed pigs aberrations of chromatid type as gas and chromatid breakage were mostly represented. The total number of spontaneous chromosomal aberrations in healthy pigs was 0.1%. After exposure of blood to high-energy-X-rays, already during the first 24 hours after irradiation a significant increase of the number of specific chromosomal aberrations took place (table 1).

Table 1. Frequency of chromosomal aberrations in lymphocytes of pigs after in vitro irradiation of blood with X-rays.

| Dose in Gy | No. of anal. cells | Structural aberrations of chromosomes: Chromatid Gap | Chromatid Break. | Chromosomal Break. | Chromosomal Ac.fragm. | D+R | Change of ploidity | % of aberrations |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 1105 | - | 1 | - | - | 1 | 4 | 0.54 |
| 0.1 | 1000 | 4 | 1 | - | 3 | 3 | 4 | 1.50 |
| 0.2 | 1000 | 9 | 3 | - | 3 | 5 | 3 | 2.30 |
| 0.5 | 1000 | 2 | - | - | 7 | 6 | 3 | 2.80 |
| 1.0 | 1000 | 4 | - | 3 | 16 | 18 | 7 | 4.80 |
| 2.0 | 1000 | 15 | - | 1 | 91 | 76 | 8 | 19.10 |
| 3.0 | 1000 | - | - | - | 241 | 255 | 16 | 51.20 |

D - dicentric, R - ring

It can be noticed from the obtained results that with the increase of radiation dose increases also the number of specific chromosomal aberrations. For the lower radiation doses (up to 0.5 Gy), the number of aberrations was represented with a linear parameter, and for higher dose levels with a square parameter. On the basis of obtained results, it is possible to work out the calibration dose-response curve, which is the mathematical, statistical and graphic presentation of an experimentally determined relation between the number of specific chromosomal aberrations and the absorbed radiation doses, what will be the subject of our further investigations.

## CONCLUSION

Cytogenetic dosimetry of ionizing radiation is one of the methods for early detecting of radiation damages in domestic animals. By applying this method, already during the first 24 hours after irradiation of pigs (much before the appearance of clinical symptoms of the disease) it is possible to estimate the level of radiation damage on the basis of specific chromosomal aberrations and to undertake protection measures and/or measures of economical exploitation of irradiated animals. For more reliable estimation of the absorbed radiation dose it is necessary to work out also calibration dose-response curves, which are a mathematical, statistical and graphic presentation of experimentally determined relationship between the number of chromosomal aberrations and the absorbed radiation doses. On the basis of these curves it is possible to estimate the absorbed radiation doses in people and animals in accidental and emergency situations.

## REFERENCES

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