

BIOMARKER STUDIES IN IONIZING RADIATION AND CYTOSTATIC EXPOSURE

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Objective

In Hungary, employer should perform risk assessment in case of occupational carcinogenic exposure, by the law. Biological monitoring provides opportunity to identify the high-risk group among medical personnel. After giving detailed instructions to the employees of an oncology department under study several types of genotoxicity tests were carried out. A multi-endpoint monitoring panel was applied in biological samples of employees exposed to genotoxic agents (cytostatics, ionizing radiation) to assess the risk.

Materials and Methods

The standard plate incorporation Salmonella Ames mutagenicity test was performed on the concentrated and standardized urine samples of the exposed population. The TA 98 and 100 tester strains were used in absence and presence of a deconjugation enzyme mix. Short term cytogenetic tests – sister chromatid exchange (SCE), micronucleus (MN) and in one case chromosomal aberration test (CA) – were also performed on peripheral blood samples.

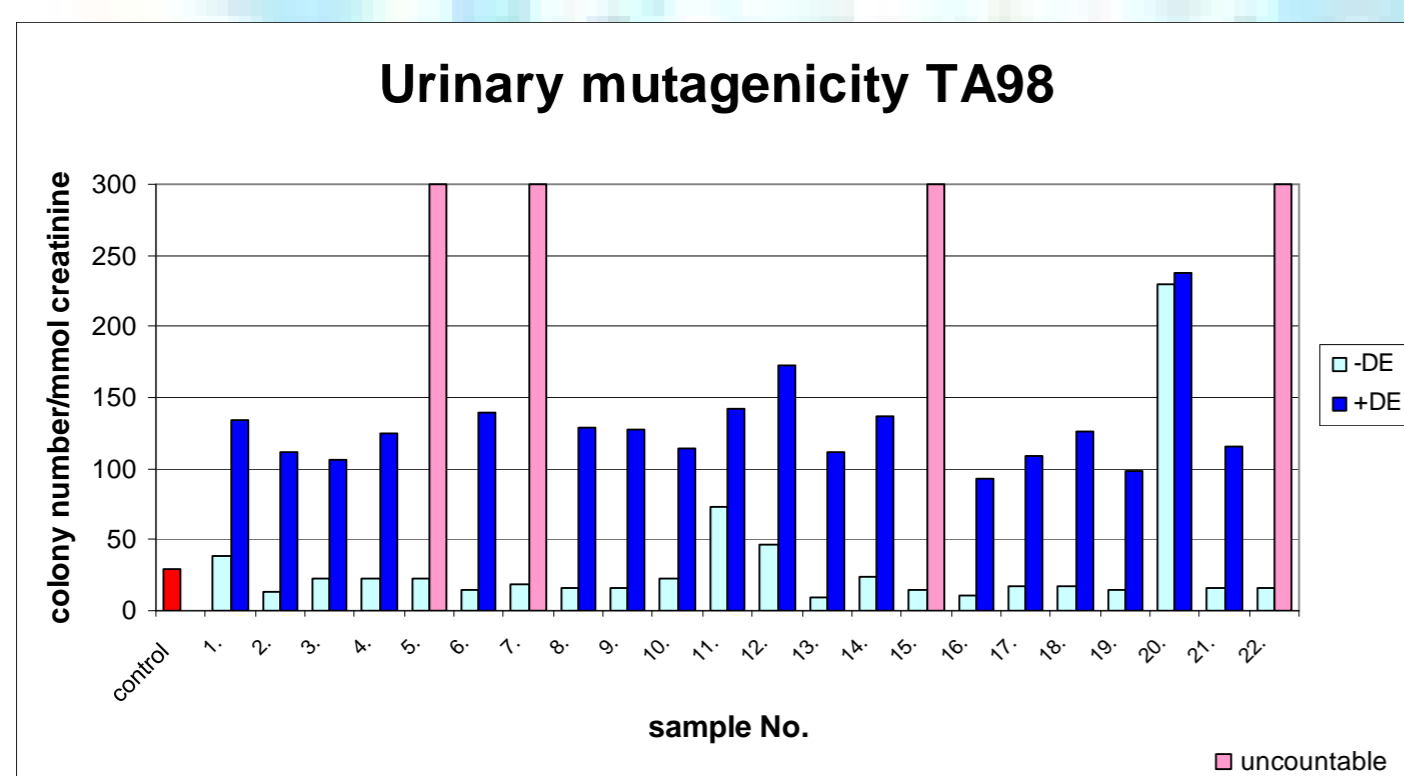


Figure 1/a. Mutagenicity of urine samples by using TA 98 strain with and without deconjugation.

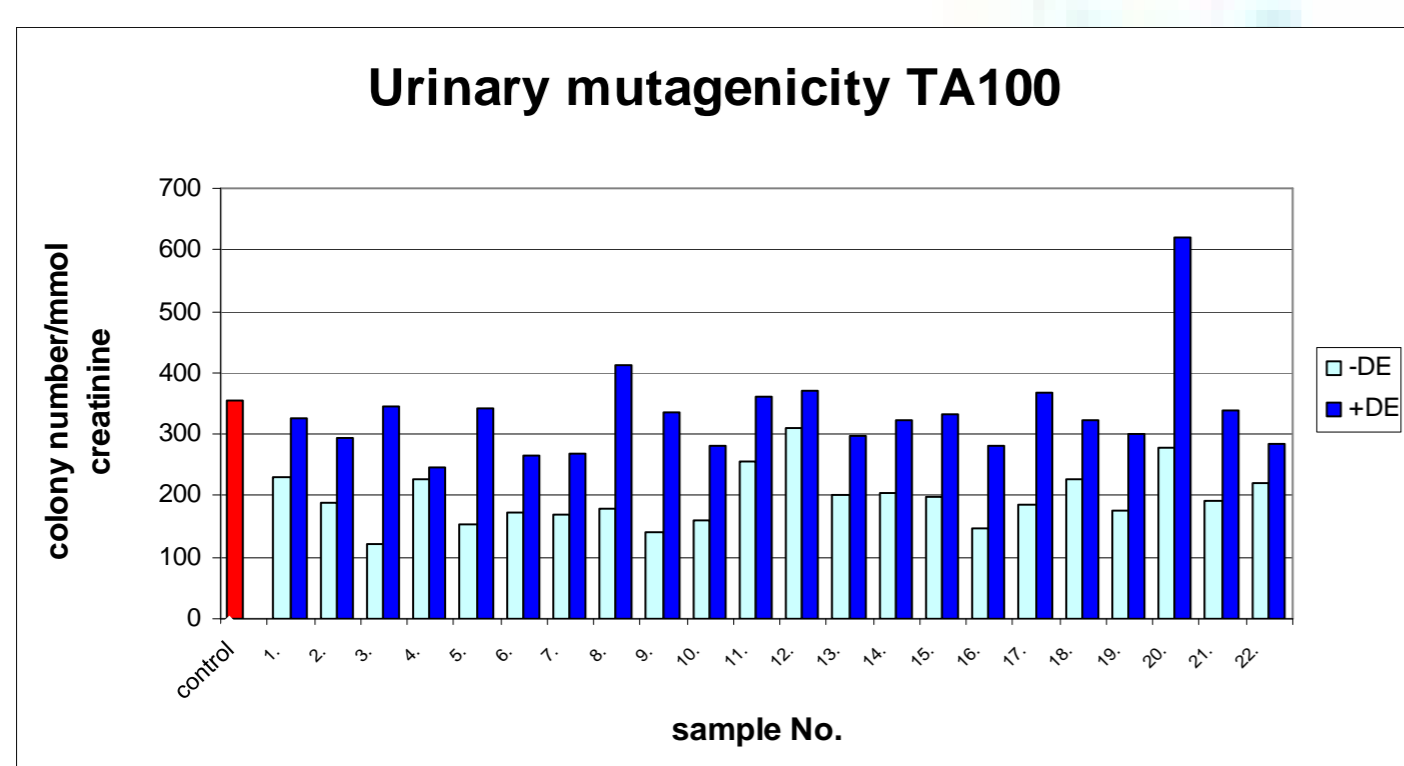


Figure 1/b. Mutagenicity of urine samples by using TA 100 strain with and without deconjugation.

Results

Urine samples were proved to be mutagenic in presence of deconjugation enzymes in the Ames test indicating a mutagenic occupational exposure (Figure 1/a, b). Extremely high MN frequency was detected in one case (Figure 2). This worker was also tested for CA with positive result (14%). SCE inducing effect could not be observed (Figure 3). Due to the lack of paired control values, therefore mean + 2 SD was applied as upper limit of negative result.

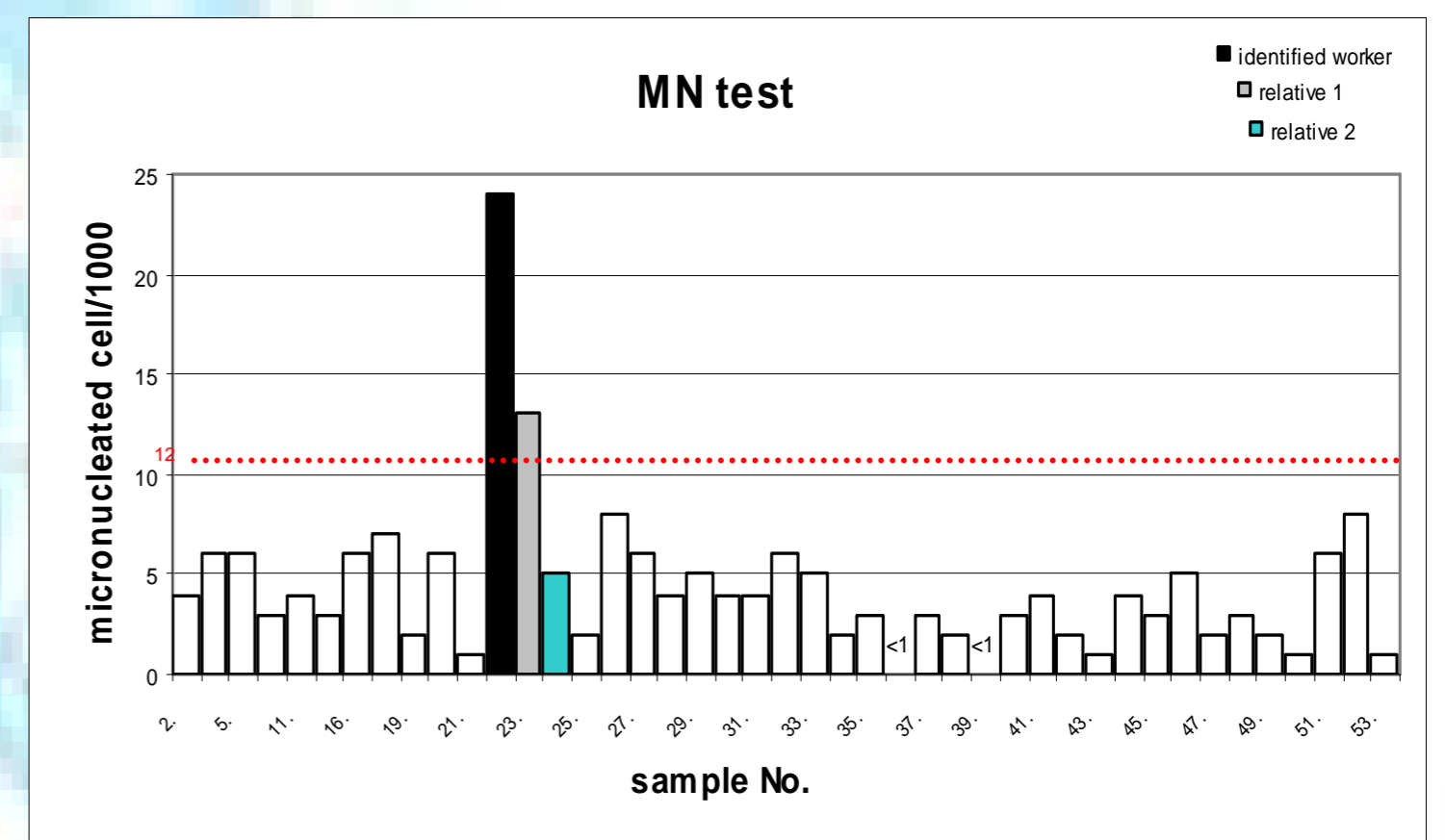


Figure 2. MN test results of workers supplemented with two relatives of the high risk individual. Upper limit of the normal value is 12%.

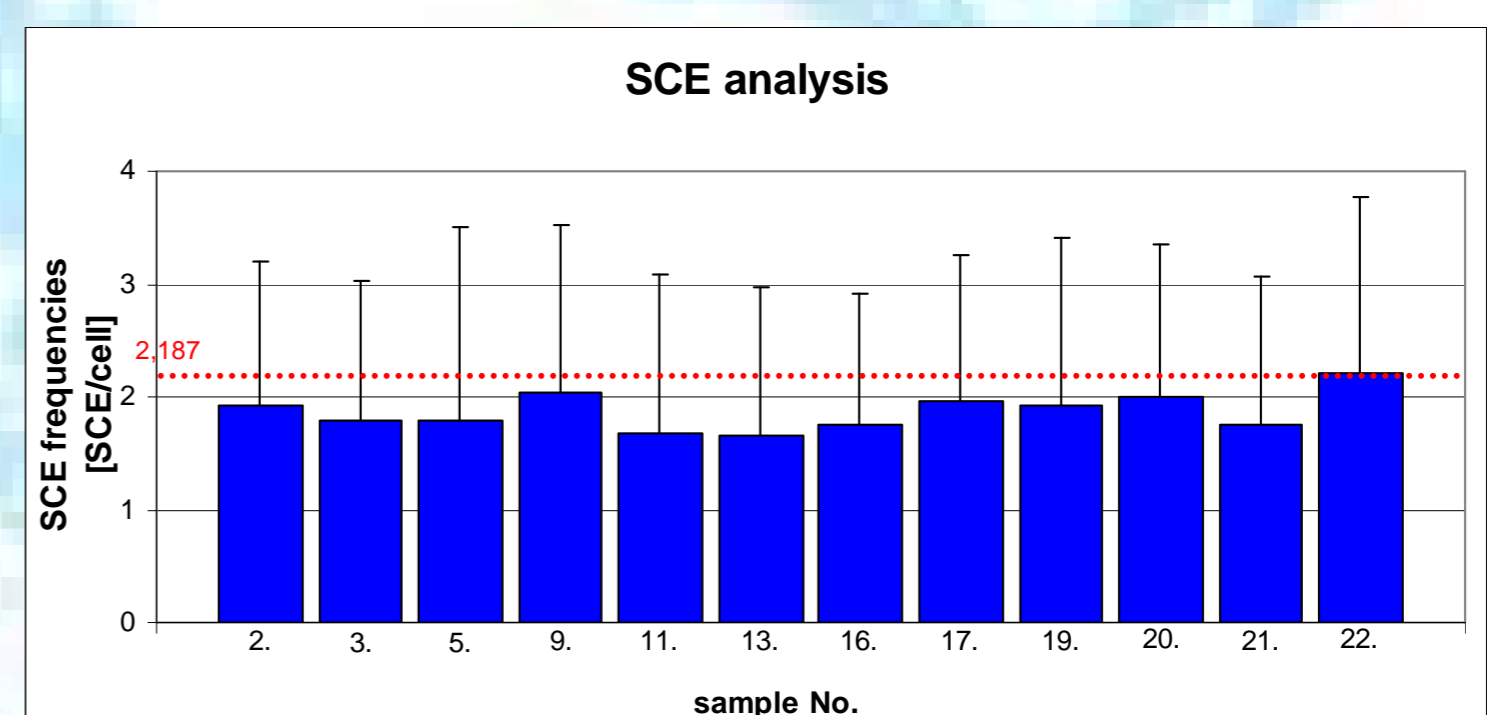
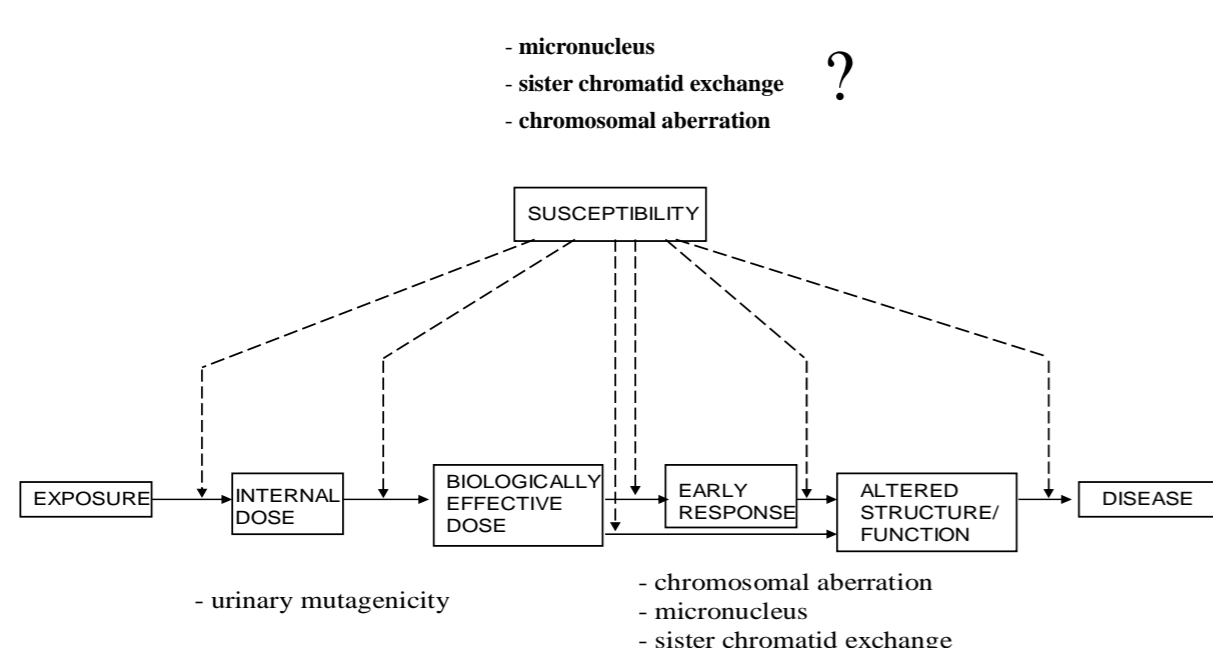


Figure 3. SCE/cell results of the workers. Upper limit of the normal value is 2.187.

OVERVIEW OF GENOTOXICOLOGICAL BIOMARKERS APPLIED



Acknowledgements

The authors thank dr. Géza Török for technical help and Mrs. Cecilia Strasz-Bánki for collecting samples.

Discussion

To detect the internal dose of chemical agents, urinary mutagenicity monitoring was performed in Salmonella Ames test. Cytogenetic assays (CA, MN, SCE) were used as early effect markers of mutagenic exposure. CA and MN analyses are applicable for biological dosimetry of radiation-exposure. The Ames test results clearly confirm the manifestation of mutagenic exposure. It probably means minimal individual additional risk. The cytogenetic tests (CA, MN, SCE) showed different sensitivity – as early response markers – to the particular exposure. In the MN test one outlier was observed. Lymphocytes of this worker also showed high frequency of CA. Considering the lack of radiation exposure in the anamnesis the employees' closest relatives were also examined in MN test. Results suggest rather the genetic background was responsible for the individual deviations. As a conclusion of the study, follow-up examinations are needed to identify individuals in high risk under these occupational circumstances.