Cytogenetic follow-up study, over 4 years, of three individuals accidentally exposed to ^{60}Co in Bulgaria

Albena Staynova*, Dimka Georgieva, Ljubomira Popova, Rositsa Hristova
National Centre of Radiobiology and Radiation Protection, Sofia, Bulgaria
**E-mail: a.staynova@ncrrp.org*

Introduction

A severe irradiation accident involving 5 victims occurred Thuesday, 14 June 2011 in an industrial irradiation facility operated by Gitava private company at Stamboliysky in Bulgaria (1). This company uses irradiation to sterilise medical and cosmetic equipment with very high-activity gamma sources.

The origin of the accident was a previous undetected wrong recharging process resulting in an unknown position of a radioactive source holder. During the preparation for recharging the gamma-irradiation facility with ^{60}Co sources, a cylinder already recharged with ^{60}Co sources has been taken out instead of an empty one due to this error. As a result five workers were exposed to a powerful gamma-radiation for approximately 5 to 10 minutes. The activity in June 2011 was 137 TBq (3710 Ci). The purpose of this study was to examine the frequency of dicentrics and rings (dic+r) over time after a real case of accidental exposure.

Methods

Short-term whole blood lymphocyte cultures were set up according to a standard protocol as described (2). Conventional chromosomal aberration analysis was performed by scoring dic+r in peripheral blood lymphocytes from three of the victims. The course of unstable chromosomal frequency (dic+r) was analysed at four time-points after the first examination. Only metaphases with complete number of 46 chromosomes were analyzed.

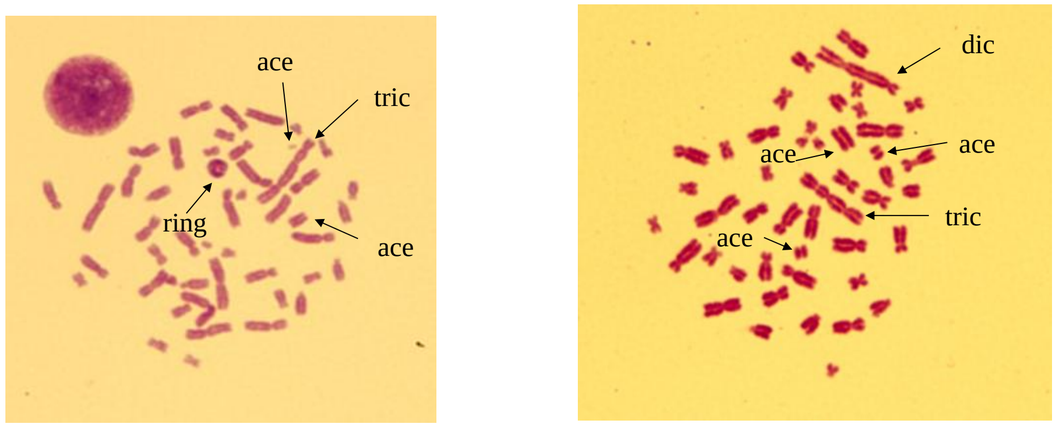
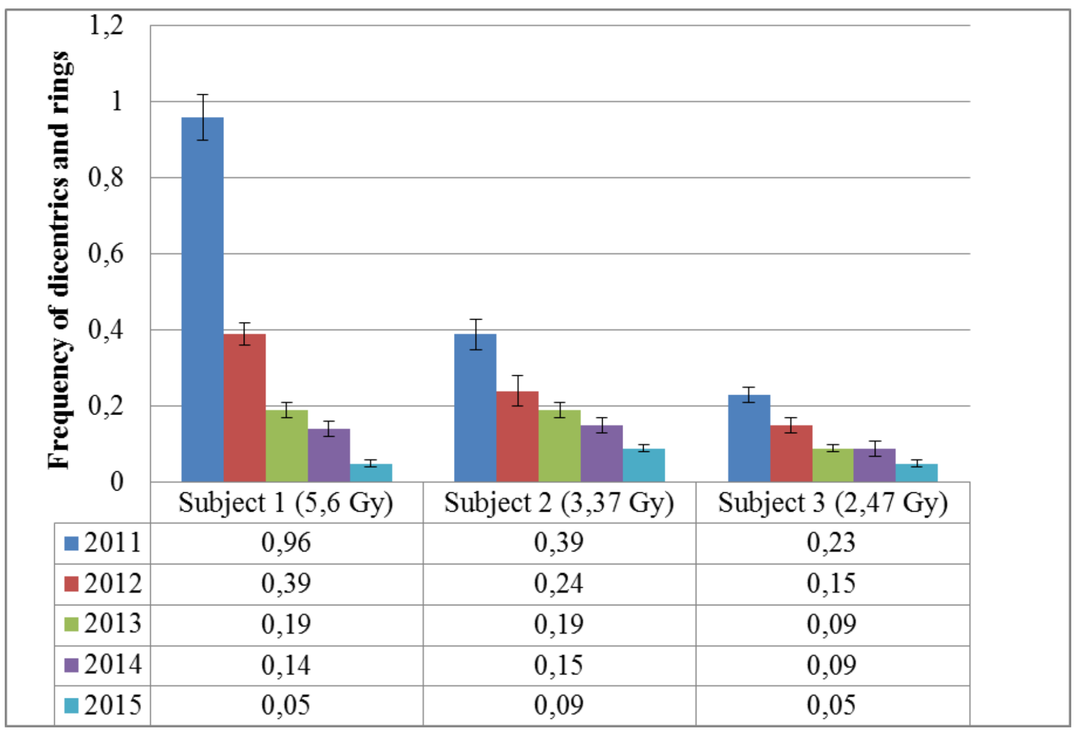


Figure 1. Metaphases with dicentric, multicentric and ring chromosomes as well as acentric fragments in lymphocytes of subject 1.

Results



	Subject 1 (5,6 Gy)	Subject 2 (3,37 Gy)	Subject 3 (2,47 Gy)
2011	0,96	0,39	0,23
2012	0,39	0,24	0,15
2013	0,19	0,19	0,09
2014	0,14	0,15	0,09
2015	0,05	0,09	0,05

The results show that unstable chromosomal aberrations declined during the research period. One year after exposure, the dic+r frequencies decreased to 41-65% of their initial levels and still showed dose dependence. For the person with the highest dose (5,6 Gy) the frequency of aberrations fell faster as a function of time and four years post-irradiation it was reduced with 95%. For the subjects who had been exposed to lower doses (3,37 Gy and 2,47 Gy), the course of elimination was slower. Although we observed gradual disappearance in the frequency of unstable chromosomal aberrations, at the end of the studied period it was still much higher than the control level, found in Bulgarian control population (3).

Figure 2. Unstable chromosome aberrations (dic + r) in three of the victims from 40 h to 4 years after accidental exposure.

Conclusions

The follow-up study extending over four years revealed a reduction in the frequencies of dic+r in the lymphocytes from three victims, accidentally exposed to ^{60}Co. The kinetic attenuating frequency of unstable chromosomal aberrations with the time seems to depend on the dose received by the individual.

References

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