G2 repair and chromosomal damage in lymphocytes from workers occupationally exposed to low-level ionizing radiation

Abstract

The effect of the G2 repair of chromosomal damage in lymphocytes from workers exposed to low levels of X- or gamma-rays was evaluated. Samples of peripheral blood were collected from 15 radiation workers, 20 subjects working in radiodiagnostics, and 30 healthy control donors. Chromosomal aberrations (CA) were evaluated by scoring the presence of chromatid and isochromatid breaks, dicentric and ring chromosomes in lymphocytes with/without 5 mM caffeine plus 3 mM-aminobenzamide (3-AB) treatment during G2. Our results showed that the mean value of basal aberrations in lymphocytes from exposed workers was higher than in control cells ($p < 0.001$). The chromosomal damage in G2, detected with caffeine plus 3-AB treatment was higher than the basal damage (untreated conditions), both in control and exposed populations ($p < 0.05$). In the exposed workers group, the mean value of chromosomal abnormalities in G2 was higher than in the control ($p < 0.0001$). No correlation was found between the frequency of chromosome type of aberrations (basal or in G2), and the absorbed dose. Nevertheless, significant correlation coefficients ($p < 0.05$) between absorbed dose and basal aberrations yield ($r = 0.430$) or in G2 ($r = 0.448$) were detected when chromatid breaks were included in the total aberrations yield. Under this latter condition no significant effect of age, years of employment or smoking habit on the chromosomal aberrations yield was detected. However, analysis of the relationship between basal aberrations yield and the efficiency of G2 repair mechanisms, defined as the percentage of chromosomal lesions repaired in G2, showed a significant correlation coefficient ($r = -0.802$; $p < 0.001$). These results suggest that in addition to the absorbed dose, the individual G2 repair efficiency may be another important factor affecting the chromosomal aberrations yield detected in workers exposed to low-level ionizing radiation.