【P-17】

Measurement of DNA damage in Welders Exposed to Chronic Low-Dose Stainless-and Mild Steel Welding Fume

Seung-Hee Maeng, Soo-Jin Kim, Hae-Won Cho, Jeong-Hee Han, Jae-Hyuk Sung, Young-Kyu Park and Il-Je Yu

Chemical Safety and Health Research Center, Occupational Safety & Health Research Institute, Korea Occupational Safety and Health Agency, Daejeon, Korea

The mechanisms involved in welding fumes-induced lung fibrosis and cancer seem to include production of reactive oxygen species (ROS). We examined a group of steel pipe making welders (42 individuals) at risk of chronic exposure to low doses of welding (MAG-SS and MAG-MS) fume. Age, smoking and alcohol-consuming status, use of therapeutic drug and work-duration were informed with questionares. For each individual, the environmental monitoring for occupationally exposed welding fume level was done with the personal air sampling. An age and sex-matched group of controls was chosen among the administrative employees (48 individuals). We detected the 8-oxoguanine (8-oxoG or 8-oxodG) levels by immunohistochemistry in peripheral lymphocytes to compare the oxidative DNA damage in welders and in controls. The alkaline single cell gel electrophoresis (Comet assay) was used to measure DNA breaks and alkali-labile sites. We also used the method (fragment length analysis with repair enzyme, FLARE) in combination with oxidative base damage-specific enzymes, foramidopyrimidine glycosylase (FPG) and endonuclease III (Endo III), to estimate oxidative DNA damage in the same individuals. The mean age of the studied population was 38.9 years and 38.5 years in welders and in controls, respectively. The mean work duration of the welders was 15 years (1~33 years). The environmentally exposed concentrations of total fume, metals such as Fe, Cr, Mn and gases (NO2 and O3) were extremely lower than the occupational exposure levels (OEL). 8-oxodG level in welders was significantly lower than the controls, while damage levels of DNA breaks and alkali-labile sites in welders measured by Comet assay was higher than the controls. As for FPG/Endo III FLARE assay, we found no statistically significant increase in site specific base damage between the control and welding fume exposed group. The welding fume exposed group exhibited lower level of enzyme (FPG or Endo

III)-sensitive sites than the control; however, this diffence was significant only in Endo III sensitive sites. No statistically significant effect of smoking was seen on the level of all DNA damage determinations, both direct (DNA strand breakage and alkali-labile lesions) and enzyme-combined (base damage) in the control or in the exposed group. However, statistically significant increasing effect of smoking could have been found on the oxidative DNA damage, 8-oxodG level in the exposed groups. Neverthless, 8-oxodG level in the exposed group was lower than the control. There was no correlations of all DNA damage (direct and enzyme-combined) to age and work duration variables either in the control or in the exposed group. However, the inverted correlation between 8-oxodG and work duration was statistically significant ($p<0.05$). From the above findings, comet assay was suggested as being suitable as a biological dosimetry for DNA damage induced by chronic low dose welding fume exposure. However, further investigations were necessary because of its lack of correlation to work duration, indirect exposure indicator.

Keyword: Welders, 8-oxodG, Immunostaining, Single Cell Gel Electrophoresis (Comet assay), Fpg/Endo III FLARE assay