Review of results from epidemiological studies of miners

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Abstract

Studies of miners played a major role in the classification of radon gas and its decay products as a certain lung carcinogen for humans by the International Agency for Research on Cancer in 1987. A comprehensive review of epidemiological results from miners' studies was published in the BEIR VI report in 1999. Since then, many results have been published. The present paper reviews the results related to cancer risks associated to alpha emitters obtained from miners' studies since 1999. More than 40 articles or reports are reviewed.

Data from eleven cohorts were considered in the BEIR VI report. Since 1999, six of these cohorts have been enlarged or extended. Additional data, not available at the time of the BEIR VI report, have also been collected, such as additional data about mines exposures (gamma rays, inhalation of uranium ore dust), smoking behaviour, information about morbidity or histology of the cancers. Some revision of dosimetric estimates also occurred. New cohorts have developed in Germany, in the Czech Republic and in China. Also, some collaborative research programs were launched, especially in Europe and are presently supported in the frame of the Alpha-risk project.

This involvement of the available data provided the basis for many research works. Most of the studies aimed at a better quantification of the relation between radon exposure and lung cancer risk. Globally, the results confirm the existence of a significant association, compatible with a linear relationship. A decrease of the magnitude of the association is consistently found with time since exposure. A modifying effect of age at exposure is also repeatedly observed. The existence of an inverse exposure-rate effect, suggested by some studies, is not confirmed at low levels of exposure. It was also confirmed that a radon associated lung cancer risk persists after taking into account smoking. Some studies provided results on diseases other than lung cancer. Especially, several articles dealt with the risk of leukaemia among uranium miners, but further analyses are needed before concluding on a causal association with inhalation of radon or long-lived radio-nuclides present in the mines. Ongoing researches should improve the quantification of risks associated to low levels of chronic exposure, considering the potential confounding effect of other pollutants present in the mines.

A synthesis of all these results is proposed. The limits and advantages of the miners' studies will be discussed, especially regarding their interest in the evaluation of risks associated to alpha emitters at low levels of chronic exposure.

KEYWORDS: Epidemiology, Radon, Miners, Lung cancer.

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