

Epidemiology of Breast Cancer Risk Following Radiation Exposures

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The experience of the survivors of the atomic bombings of Hiroshima and Nagasaki clearly demonstrates that radiation exposure results in a dose-dependent increase in cancer risks. For solid cancers, i.e. cancers other than leukemia and other cancers of the hematopoietic system, the increased risks are proportional to dose and persist throughout life. Analyses of solid cancer incidence in the bomb survivors indicate that while breast cancers constitute about 11% of all cancers among women in the cohort they make up more than 25% of the radiation-associated cancers, indicating that the breast is one of the most radiation-sensitive tissues. It has often been noted, in the survivors and other radiation-exposed populations, that the radiation associated increase in breast cancer rates relative to the baseline risks (i.e. the risk in unexposed women) depends on age-at-exposure. However, recent analyses of the survivor data suggest that much of this apparent age-at-exposure effect may be explained by a decrease in the relative risk with increasing attained age.

Radiation effects on breast cancer have also been examined in a number of populations of women who received medical, environmental, or occupational exposures. Thus, it is possible to compare radiation effects in populations with widely varying baseline rates and different types of exposure (acute, high-dose rate exposures in atomic bomb survivors, localized, fractionated medical exposures, and low dose rate environmental and occupational exposures). In a pooled analysis of eight breast cancer cohorts, including the atomic bomb survivors and seven medically-exposed populations with a broad range of baseline rates, we found that, while no simple model could describe the excess risks in all of the populations, a time-dependent difference between the rates in the exposed and unexposed groups across populations described the radiation-associated risks significantly better than a description in which the radiation effect is described in terms of a common ratio of the excess rate to the baseline rate.

In this presentation I will describe recent results on breast cancer from the atomic bomb survivor study and summarize the results of our pooled analysis. The presentation will emphasize that

- The breast is one of the most radio-sensitive tissues
- Attained age is at least as important an effect modifying factor of the radiation-associated excess risk as is age at exposure
- Pooled analyses suggest that the absolute increase in risk following radiation exposure is similar in different populations despite marked differences in age-specific baseline rates