Ionizing radiation and breast cancer in men (United States)

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The purposes of this study were to determine whether exposure of the vestigial male breast to ionizing radiation is associated with an increase in risk of breast cancer and, if so, to determine whether the apparent effects on risk in men are similar to those reported for women. A population-based case-control study of breast cancer in men was conducted in 10 geographic areas of the United States. Information on possible prior exposure to ionizing radiation, and on other potential risk factors for breast cancer, was obtained from personal interviews of 227 cases and 300 controls who were recruited from October 1983 to September 1986. Evidence from this study that ionizing radiation can cause breast cancer in men includes: a modest trend of increasing risk with frequency of chest X-rays; an increase in risk in men with three or more radiographic examinations, especially if received prior to 1963; and an increase in risk in men who received X-ray treatments to the chest and adjacent body areas. Risk was increased only from 20 to 35 years after initial exposure from either radiographic examinations or X-ray treatments, and declined after three to four decades since last exposure, suggesting a wave of increased risk of finite duration following exposure. The doses of radiation received could not be estimated precisely, but those from diagnostic procedures were likely similar to those received by prepubertal females in prior studies, and the results of those and the present investigation are compatible. The carcinogenic effects of ionizing radiation may be similar in the male and prepubertal female breast. Cancer Causes and Control 1994, 5, 9 - 14.

Key words: Breast neoplasms, ionizing radiation, males, United States.

Introduction

Ionizing radiation has been shown to cause breast cancer in women. Increased risks of breast cancer have been observed in women who: were exposed to atomic bombs; received X-ray treatment for postpartum mastitis and other benign breast conditions; received multiple fluoroscopies in conjunction with...
pneumotherapy for tuberculosis; and worked as radium dial painters and diagnostic X-ray technicians. It is generally accepted that there is a linear increase in risk with dose of radiation at least up to 400 rads, although risk estimates for individuals exposed to low doses, i.e., below 20 rads, are few and imprecise.

The effect of radiation on risk has been shown in several studies to decline with increasing age at exposure, from about the age of puberty up to about age 35 or 40 years, and not to be elevated in women exposed when older than 40 years, although an increase in risk has been reported in women treated for benign breast lesions when in their 40s. Until 1987, it was believed that irradiation of the prepubertal breast did not affect risk, and that the breast was maximally sensitive to the carcinogenic effects of radiation at puberty, when it is undergoing rapid growth. However, there is now evidence that risk of breast cancer also is increased in women who were exposed to X-rays as infants for treatment of an enlarged thymus and skin hemangiomas, and at five to nine years of age for tinea capitis, as well as in women exposed before the age of 10 years to multiple diagnostic X-rays for evaluation of scoliosis and to atomic bombs. In three of these studies, some elevations in risk were observed in women who had received doses of radiation to the breast under 20 rads, and the dose was only about 1.6 rads in one investigation. Also, in the atomic bomb survivors, risk was higher in the women who were under age nine than in 10- to 19-year olds at the time of exposure, although this was not observed in a study of multiple fluoroscopies, and it is therefore unclear whether the risk is higher in women with prepubertal than pubertal exposure.

The latent period between exposure and the occurrence of breast cancer appears to be longer in women who had received doses of radiation in relation to breast cancer in men, but have yielded little detailed information due to their small numbers of subjects. We report here results from the largest case-control study to date of breast cancer in men, on risk of this condition in relation to various sources and features of ionizing radiation.

Materials and methods

A detailed description of the methods utilized in this study has been published. Briefly, attempts were made to recruit as cases all non-institutionalized male residents of 10 areas covered by population-based cancer registries of the Surveillance, Epidemiology, and End Results (SEER) program of the United States National Cancer Institute, who were newly diagnosed as having primary breast carcinoma from October 1983 through September 1986. Cases were identified through the reporting system of each registry. Either one or two non-institutionalized controls were selected for each interviewed case, on an alternating basis, to provide a control to case ratio of approximately 1.5 to one. Controls were matched individually to cases on age (same five-year age group) and geographic area; those under age 65 were selected by random-digit dialing, and older controls were selected from randomly generated samples of Medicare registrants provided by the Health Care Financing Administration.

Standardized personal interviews of the study subjects were utilized to obtain information on socioeconomic status, prior conditions possibly indicative of hormonal aberrations, exposure to exogenous hormones and drugs (including alcohol and tobacco), the two occupations held the longest, family history of breast cancer, and dietary habits.

Of particular relevance to this report, information was obtained on prior exposure to diagnostic and therapeutic radiation. Study subjects were asked to recall the years of their first and last chest X-rays and the total number they had received, and they were shown a card with six possible frequencies of chest X-rays and asked to show the one that best described their own experience. They were then asked if they ever had prior radiation treatments; and if they had, the year, body part treated, and number of treatment sessions were ascertained. Subjects then were asked whether they ever received a fluoroscopic examination, and if so the year of each examination, the body part examined or type of examination, and the number of examinations of that body part or type. The types of examinations include upper and lower gastrointestinal series, intravenous pyelogram, gall bladder series, myelogram, cardiac catheterization, and pneumothorax treatment for tuberculosis. Since some of these

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