

Effects of low doses of A-bomb radiation on human lifespan

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Abstract

Among about 100,000 A-bomb survivors registered at Nagasaki University School of Medicine, male subjects exposed to 31 - 40 cGy showed significantly lower mortality from non-cancerous diseases than age-matched unexposed males. And the death rate for exposed male and female was smaller than that for un-exposed. It was presented that the low doses of A-bomb radiation increased lifespan of A-bomb survivors.

1. Introduction

The hypothesis that radiation is hazardous even at small doses without threshold has been widely accepted. Bases on this hypothesis, radiation protection practices have presumed low-dose risk estimates by linear extrapolation from observed high-dose effects. However, the validity of the no-threshold model has seldom been critically assessed with actual data with actual data on humans exposed to low doses. Simizu *et al.* continued studies on mortality of a large cohort of A-bomb survivors in Hiroshima and Nagasaki, which is called RERF (Radiation Effects Research Foundation) population, and concluded that there was no threshold of the increase in the relative risk of mortality with radiation doses, even though there were their findings that death rate frequently showed seemingly lower values in persons exposed to low doses than unexposed persons [1]. The importance of U-shaped dose-response relationship was first pointed out by Stewart and Kneale, using the RERF population [2-3]. We examined the effects of low doses in a cohort of Nagasaki A-bomb survivors which are considerably different from the Nagasaki survivors included in the RERF population.

2. Materials and Methods

Since 1970, a database of about 100,000 A-bomb survivors in Nagasaki has been maintained at the Atomic Bomb Disease Institute at Nagasaki University School of Medicine [4-5]. The data include personal histories, cumulative records of health checks and death certificates. The data for all persons recognized as A-bomb survivors and given an A-bomb

Health Book from Nagasaki City have been collected. From the data, we selected those for a total of 3456 persons exposed more than 1 cGy and a total of three times 3456 persons age-matched controls who were alive in 1970. The control group (zero-exposure) consisted of persons with the A-bomb Health Hand Book who were more than 3 km from the hypocenter at the time of the A-bombing. Persons who moved out of Nagasaki City before were not included in this follow-up study, therefore death certificates were obtained with 100% efficiency. The relative risk of deaths (total deaths, deaths from cancer, and deaths from non-cancerous deaths) in 1970-1988 was analyzed.

3. Results and Discussion

The relative risk of death from all causes, cancer and non-cancer was analysed. For deaths from all causes, the relative risk did not show significant increase with dose. The relative risk of deaths from cancer increased with a dose threshold at about 50 cGy. However, for non-cancer deaths, the relative risk at 31 - 40 cGy range was below unit for male statistically significant ($p < 0.05$) as shown in Figure 1.

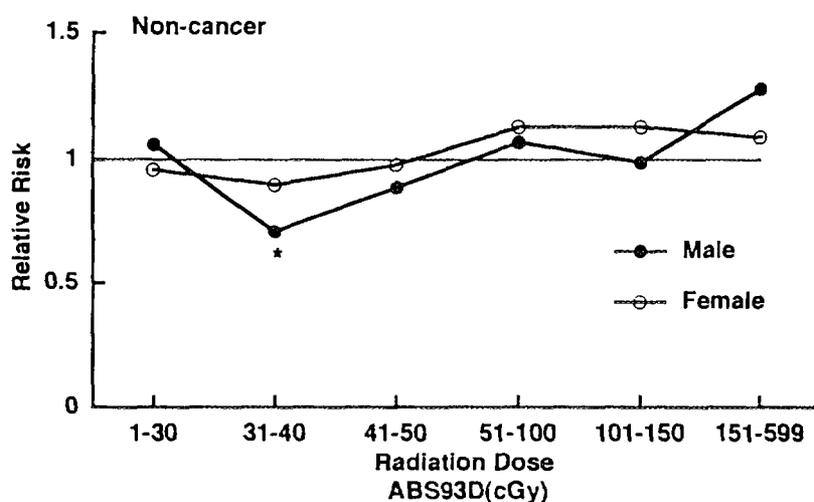


Figure 1. The relative risk of death from non-cancer.

Figure 2 shows the death rate for male and female. Closed symbols are of A-bomb survivors whose exposed radiation dose was less than 0.5 cGy and was assumed as non-exposed. Open symbols are of A-bomb survivors whose exposed radiation dose was more than 1 cGy and was assumed as exposed. The average of dose of exposed population was 125 cGy. The death rate was lower for exposed A-bomb survivors than for non-exposed survivors.

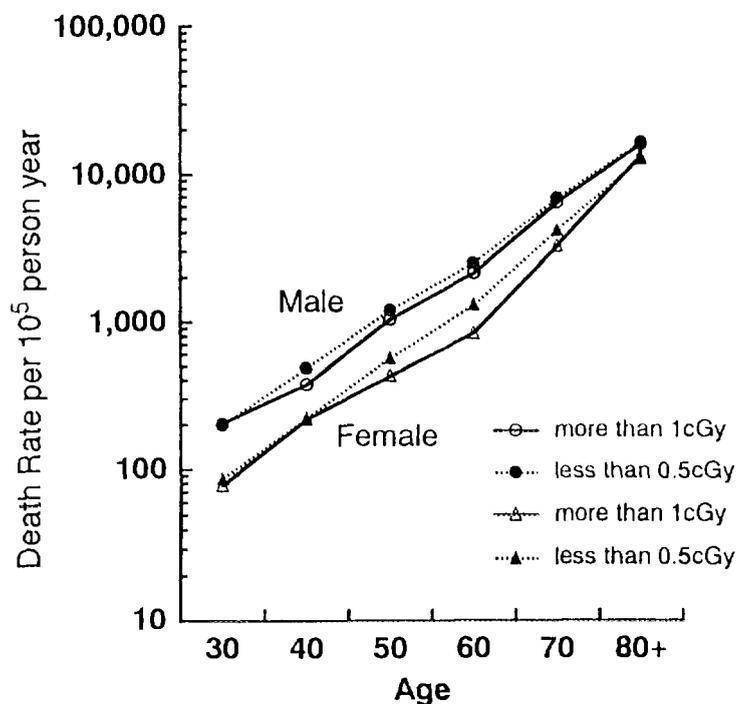


Figure 2. Death rate of A-bomb survivors in comparison with exposed doses.

It is clear that A-bomb radiation causes cancer in survivors dependent on radiation dose. The above data suggest that small doses of A-bomb radiation decreased death rate and relative risk and that increased lifespan of A-bomb survivors [6].

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