

A research paper published in *Radiation Research*<sup>§</sup>

### “Glaucoma in Atomic Bomb Survivors”

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#### Study Findings

A previous paper reported that glaucoma incidence in the Adult Health Study (AHS), based on medical history information, decreased with increasing atomic-bomb radiation dose. This finding prompted the conduct of a cross-sectional glaucoma study based on systematic ophthalmologic examinations. The study’s results suggested that the prevalence of normal-tension glaucoma, but not glaucoma with elevated eye pressure, may have increased with A-bomb radiation dose. The estimated odds ratio at 1 Gy was 1.31 (95% confidence interval: 1.11–1.53,  $P = 0.001$ ) for normal tension glaucoma. However, uncertainties exist in the results because of the study’s low participation rate and the resulting possibility of selection biases. The findings therefore should be interpreted cautiously until confirmed by other studies.

#### Explanation

While glaucoma has been found in 7–11% of patients as a complication of high radiation dose (e.g., radiotherapy), it is not understood whether radiation at low-to-moderate doses gives rise to glaucoma. Systematic ophthalmologic examinations were conducted to evaluate the possibility of excess glaucoma cases in relation to A-bomb radiation exposure.

#### 1. Study purpose

To elucidate the association between glaucoma prevalence and A-bomb radiation, taking other potential risk factors into consideration.

#### 2. Subjects and methods

Of the 2,699 people who underwent health examinations in the AHS clinical program between October 2006 and September 2008, the prevalence of glaucoma in relation to estimated A-bomb doses was analyzed among the 1,589 people who participated in the glaucoma study. However, the low participation rate (59%) introduced more uncertainty into the results and the potential for selection biases. Upon conducting medical interviews and ophthalmologic examinations, individuals with an indication of ocular disease, including glaucoma, were referred to local medical institutions for more comprehensive evaluations. Glaucoma was diagnosed by glaucoma specialists on the basis of specific changes in the optic nerve head, visual field test results, and other related ocular findings.

#### 3. Results

Of the 1,589 people, a total of 284 (17.9%) individuals were diagnosed as having glaucoma in one or both eyes: 36 (2.3%) primary open-angle glaucoma cases (intraocular pressure  $\geq 21$  mmHg), 226 (14.2%) normal-tension glaucoma cases, and 25 (1.6%) primary closed-angle glaucoma cases. Logistic regression analysis with adjustment for gender, age, city, cataract surgery, and diabetes mellitus, revealed an estimated odds ratio at 1 Gy of 1.31 (95% confidence interval: 1.11–1.53,  $P = 0.001$ ) for normal-tension glaucoma, but no association with radiation dose was observed for the other types of glaucoma.

#### 4. Conclusion

This study’s findings suggest that the prevalence of normal-tension glaucoma may increase with A-bomb radiation dose. However, the low participation rate in the study and possible

potential for selection biases introduced as a result warrant a cautious interpretation of these results.

5. Significance of this study and tasks ahead

This study, based on diagnoses made by ophthalmologists, suggests that normal tension glaucoma may increase with A-bomb radiation dose. However, this finding must be confirmed by other studies, and an epidemiological study that minimizes uncertainties and potential selection biases needs to be conducted. If the association is confirmed, then studies could be pursued of possible underlying biological mechanisms.

**The Radiation Effects Research Foundation** has studied A-bomb survivors in Hiroshima and Nagasaki for more than 60 years. RERF's research achievements are considered the principal scientific basis for radiation risk assessment by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and for recommendations regarding radiation protection standards by the International Commission on Radiological Protection (ICRP).

<sup>§</sup>***Radiation Research***, which is an official monthly journal of the Radiation Research Society, publishes original, peer-reviewed papers and review articles on radiation effects and related issues in the fields of physics, chemistry, biology, and medicine. (Impact factor in 2012: 2.698)