“Association between Chronic Kidney Disease and Cardiovascular Disease Risk Factors in Atomic Bomb Survivors”
doi: 10.1667/RR2863.1

[Findings of this study]
We observed among the A-bomb survivors an association between chronic kidney disease (CKD) and the cardiovascular disease (CVD) risk factors of hypertension, diabetes mellitus (DM), hyperlipidemia, and metabolic syndrome (MetS). Furthermore, we observed an association between CKD and radiation dose. It was observed that the most severe category of CKD (severe renal dysfunction) in particular was significantly associated with radiation dose.

[Explanation]
It is still much debated whether the mechanism behind development of CVD is the same for high-dose exposure from cancer radiotherapy (50–60 Gy) and exposure in the A-bomb survivors (1–4 Gy). However, an association between A-bomb radiation dose and the metabolic CVD risk factors including hypertension, abnormal lipid profiles, fatty liver, and high inflammatory marker values has been observed, suggesting the possibility of involvement of such factors in the increase of CVD among the A-bomb survivors.

In recent years, CKD has become known as a risk factor for CVD. CKD is a new disease concept advocated by the U.S. National Kidney Foundation in 2002. An association between renal failure mortality and radiation dose was recently reported in terms of the A-bomb survivors and kidney disease, but until now, there had not been any reports and little was known about the association between A-bomb radiation and CKD.

Dr. Nobuko Sera and others of the Radiation Effects Research Foundation (Department of Clinical Studies, Nagasaki Laboratory) conducted a study on the association between CKD and hypertension, DM, hyperlipidemia, and MetS, and the association between exposure dose and CKD as well as renal dysfunction among the Adult Health Study (AHS) participants in Nagasaki. The results from the study were published in Radiation Research.

1. Purpose of the study:
To examine the association between CKD and the CVD risk factors of hypertension, DM, hyperlipidemia, and MetS, and the association between exposure dose and CKD.
2. Materials and methods:

We classified renal dysfunction in 1,040 AHS participants in Nagasaki, who were examined in 2004–2007, as normal (121 persons; estimated glomerular filtration rate [eGFR] ≥90 ml/min/1.73 m²); mild (686 persons; eGFR 60-89 ml/min/1.73 m²); moderate (217 persons; eGFR 30-59 ml/min/1.73 m²); or severe (16 persons; eGFR <30 ml/min/1.73 m²). We diagnosed subjects in the moderate and advanced renal dysfunction groups as having CKD (233 persons; eGFR ≤59 ml/min/1.73 m²) based on general diagnostic standards.

After then adjusting for age, gender, and smoking and drinking habits, we investigated associations between CKD and hypertension, DM, hyperlipidemia, and MetS. Out of the 1,040 participants, we analyzed the associations between CKD/renal dysfunction and radiation dose for 746 participants whose A-bomb doses were known.

3. Results of the study:

1) Association between CKD and CVD risk factors

CKD was found to be associated with the CVD risk factors of hypertension (odds ratio [OR], 1.57; 95% confidence interval [CI], 1.12–2.20, P = 0.009); DM (OR, 1.79; 95% CI, 1.23–2.61, P = 0.002); hyperlipidemia (OR, 1.55; 95% CI, 1.12–2.14, P = 0.008); and MetS (OR, 1.867; 95% CI, 1.32–2.63, P < 0.001), with hyperlipidemia and MetS in particular also associated with mild renal dysfunction.

2) Association between CKD and radiation dose

CKD was associated with radiation dose (OR/Gy, 1.29; 95% CI, 1.01–1.63, P = 0.038), and severe renal dysfunction was significantly associated with radiation dose (OR/Gy, 3.19; 95% CI, 1.63–6.25, P < 0.001).

Associations between radiation dose and CKD as well as advanced renal dysfunction in the A-bomb survivors were indicated for the first time. Moreover, it was revealed that CKD was associated with the CVD risk factors of hypertension, DM, hyperlipidemia, and MetS.

The aforementioned findings suggest the possibility that CKD is associated with increased CVD among the A-bomb survivors. We should be careful when interpreting the results, however, since the subjects of the present study were AHS participants in Nagasaki, and as a result, the number of those with advanced renal dysfunction was small, at only 16 persons. For this reason, we are planning a larger project involving both Nagasaki and Hiroshima AHS participants in the future.
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 assessment of radiation risk by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and recommendations regarding radiation protection standards by the International Commission on Radiological Protection (ICRP).

Radiation Research, the official monthly journal of the US Radiation Research Society, publishes original and review articles dealing with radiation effects and related subjects in the areas of physics, chemistry, biology and medicine (Impact factor in 2011: 2.684).