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“Right Bundle Branch Block without Overt Heart Disease Predicts Higher Risk of Pacemaker Implantation: The Study of Atomic-bomb Survivors”

Saburo Kusumoto, Hiroaki Kawano, Naomasa Makita, Shinichiro Ichimaru, Takashi Kaku, Daisuke Haruta, Ayumi Hida, Nobuko Sera, Misa Imaizumi, Eiji Nakashima, Koji Maemura, Masazumi Akahoshi

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Study Findings

Right bundle branch block (RBBB)¹⁾ is a common disorder observed in electrocardiograms. However, the prognosis of RBBB patients without overt heart disease has not been studied. We demonstrated that atrioventricular (AV) block²⁾ and sick sinus syndrome (SSS)³⁾ develop among RBBB patients even with no overt heart disease, and that the risk of pacemaker implantation was higher for these subjects than for those without RBBB. The risk was especially pronounced in subjects with axis deviation (AD).⁴⁾ There was no significant association between A-bomb radiation exposure and either RBBB or pacemaker implantation.

1) Impairment of intracardiac conduction of electrical signals on the right ventricular side

2) Impairment of intracardiac conduction of electrical signals at the atrioventricular node, which is the connection point between the atria and the ventricles

3) Impairment of the sinus node, which is the starting point for intracardiac conduction of electrical signals

4) Deviation of intracardiac conduction of electrical signals either to the right or the left side. When RBBB is accompanied by AD, the intracardiac electrical signal pathways are markedly impaired.

Explanation

In the Adult Health Study, which has been conducted for many years to follow the health of A-bomb survivors in Hiroshima and Nagasaki, electrocardiograms are obtained during biennial examinations. Electrocardiograms were used for diagnosis of RBBB, and subsequent clinical developments were examined.

1. Objective

The long-term prognosis of RBBB is generally benign, and it has been reported that the incidence of progression to AV block is 0–0.3%. However, in previous studies, the number of cases was limited, and no consideration was given to the presence or absence of AD. In this study, we clarified the long-term course of RBBB, using a population that has been followed for many years.

2. Methods

Among the 16,170 A-bomb survivors in Hiroshima and Nagasaki who participated in the Adult Health Study from 1967 to 2010, 520 participants developed RBBB during the study without overt heart disease. To estimate the comparative risk (hazard ratios) of pacemaker implantation, we selected 1,038 subjects without RBBB, matched for age at RBBB diagnosis and sex, to act as controls.

3. Results

(1) Risk of progression to pacemaker implantation

Hazard ratios (95% confidence interval) of pacemaker implantation in the RBBB group were significantly higher than that in the control group: when implantation was for all causes (AV block, SSS, and unclear cause), 4.79 (1.89–12.58); for AV block, 3.77 (1.09–13.07); and for SSS, 6.28 (1.24–31.73).

(2) Association between implantation risk and the presence or absence of AD

RBBB subjects with AD had a higher risk of pacemaker implantation (for all causes) than subjects without AD (hazard ratio, 3.03; 95% confidence interval, 1.00–9.13). RBBB subjects with

AD were younger than subjects without AD at the time of RBBB diagnosis (59.4 ± 7.6 and 74.4 ± 3.1 years old, respectively), and their progression to pacemaker implantation took significantly longer.

(3) Association with radiation

We conducted an analysis of the association between A-bomb radiation and RBBB or pacemaker implantation, but did not observe any significant correlation. It has been reported that high-dose radiotherapy can cause cardiac conduction disturbance. In this study, however, estimated A-bomb radiation doses were substantially lower than those experienced during high-dose radiotherapy. This suggests that lower-dose radiation exposures have no effect on the cardiac conduction system.

We demonstrated a significantly increased risk of pacemaker implantation resulting from AV block and SSS in RBBB subjects, especially when AD was present. The study also suggested that the mechanism behind the progression to conduction defect differ between patients with AD and those without AD.

The Radiation Effects Research Foundation has studied A-bomb survivors and their offspring 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). RERF expresses its profound gratitude to the A-bomb survivors and survivors' offspring for their cooperation in our studies.

[§]*International Journal of Cardiology*, which is the peer-reviewed official journal of the International Society for Adult Congenital Cardiac Disease, specializes in all aspects of cardiology and publishes papers in both basic and clinical research. (Impact factor in 2012: 5.509)