88 RADIATION-INDUCED CARDIOVASCULAR DISEASE

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It has been recognised since the 1960s that the heart may be damaged by substantial doses of radiation (>30 Gray (Gy)), such as used to occur during mantle radiotherapy for Hodgkin lymphoma. During the last few years, however, evidence that radiation-induced heart disease can occur following doses below 20 Gy has emerged from several independent sources. These sources include randomized trials of radiotherapy in breast cancer patients who received cardiac doses up to about 20 Gy and studies of survivors of the atomic bombings of Japan who received uniform whole-body doses of up to 4 Gy. Recently, a preliminary analysis of updated EBCTCG data has related mortality from heart disease to estimated cardiac doses in over 30 000 women followed for up to 20 years. There is clear evidence that the radiation-related increase is higher in trials with larger mean cardiac doses and that the risk of death from heart disease increases by 3% per Gy (95% CI, 2% to 5%; $2p < 0.00001$). This estimate can only be taken as an approximate indication of the risk, as individual treatment plans were not available for the women in those trials. Nevertheless, the data provide strong evidence that the risk of radiation-related heart disease was related to cardiac dose in these irradiated breast cancer patients. Outside the context of a randomised trial, comparisons of heart disease rates in individuals exposed to radiation at different levels are often misleading because those exposed at different levels may well have had different levels of risk in the absence of any radiation exposure. In breast cancer, however, a reliable indication of the effect of radiotherapy on heart disease can be obtained by comparing the experience of irradiated women with left-sided tumors with that of women with right-sided tumors. This can be done because cardiac radiation doses in women given radiotherapy for left-sided tumors are usually larger than the cardiac radiation doses in women with right-sided tumors, and breast cancer laterality has, in the past, played little part in determining who should be given radiotherapy. Preliminary results from some recent studies comparing women with left-sided and right-sided breast cancer will be presented.