

Radiation induced cardiomyopathy as a function of radiation beam gating to the cardiac cycle.

Recent studies indicate the oxygen content of the rat heart may decrease from the end of diastole to the end of systole by as much as a factor of 20. This observation prompted us to look for a method of sparing the heart from radiation damage by irradiating with a pulsed radiation beam gated to the heart cycle.

Rats received 20 Gy to the heart using a 2 cm diameter, 6 MeV electron beam. Radiation was delivered in 30 ms pulses centered either at the end of systole or at the end of diastole. Heart function was assessed by in-vivo measurement of the cardiac shortening fraction 60 days post irradiation using ultrasound imaging. Hearts were then excised and studied histologically to assess the amount of collagen formation secondary to radiation damage. Rats receiving gated radiation were compared to controls and to rats receiving 20 Gy radiation with no gating applied to the beam.

Significantly decreased cardiac function was observed in rats irradiated at the end of systole. Rats irradiated without beam gating and rats irradiated with the beam gated to the end of diastole were indistinguishable from the control group with regard to cardiac function. The histology results show increased damage when radiation is delivered at the end of diastole (high oxygen) and decreased damage when radiation is delivered at the end of systole (low oxygen).

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