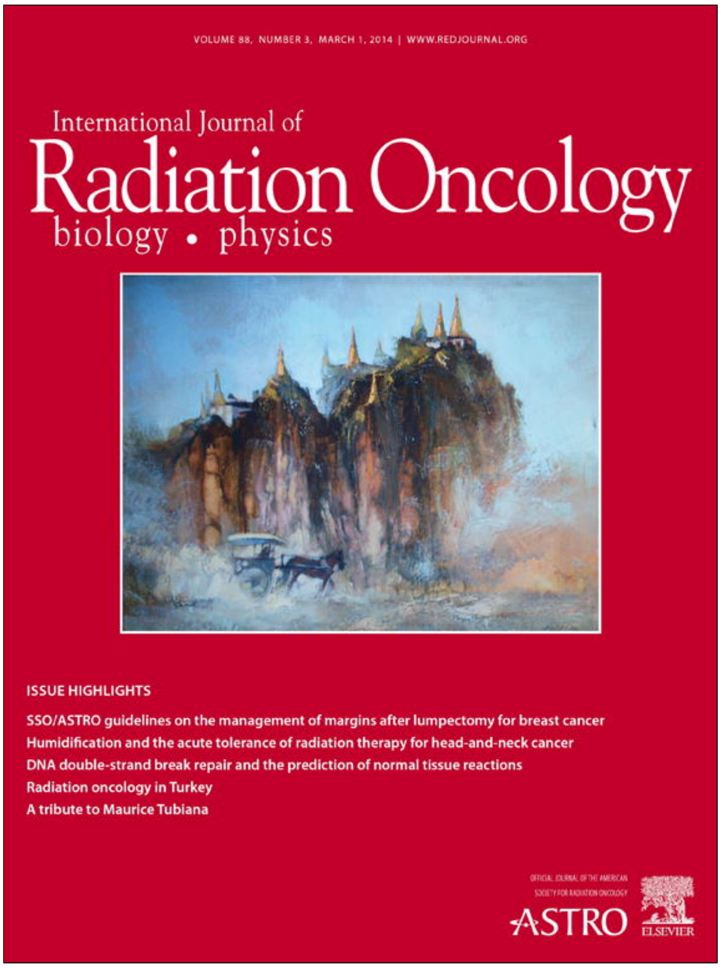
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COMMENTS

Malfunctions of Implantable Cardiac Devices in Patients Receiving Proton Beam Therapy: Incidence and Predictions

In Regard to Gomez et al

To the Editor: I read with great interest the article by Gomez et al (1), a great presentation of a survey of single-institution clinical cases regarding the noted failures of cardiac implanted electronic devices (CIEDs) of patients treated with proton beam therapy (PBT) and for various treatment sites. It is true that this article presents the largest series of CIED (42 patients with pacemakers and/or defibrillators) malfunctions in patients undergoing PBT, since the report by Oshiro et al (2) in 2008 where 8 patients with only pacemakers were considered. The observations and analysis by Gomez et al (1) are very useful to facilities that offer PBT in assisting the implementation of institutional guidelines for treating patients with CIEDs. Based on the observations reported by this study, all 4 patients who experienced device reset were receiving thoracic irradiation with passive scattering proton beam and at different dose levels (see Table 2 in Reference [1]). The authors concluded that although quantitative threshold distances and doses cannot be used for guidelines, the effect of neutron scatter on CIEDs seems to be minimal for treatment fields farther than 30 cm from the CIED. Then, they recommended that thoracic PBT be avoided for pacing-dependent patients. One possible explanation of what the authors observed in their study is that inasmuch as passive scattering mode was used for the thoracic treatments only (according to their descriptions), I would expect the out-of-field neutron scatter to be larger by a factor of 30 to 45 in the entrance region, with this factor decreasing with depth, when compared with out-of-field neutron scatter from the active scanning mode (3). For passive scattering systems, neutrons are generated in the treatment head, beam modulators, scattering devices, and patient-specific apertures or compensators and are the dominant contribution to the total dose downstream from the Bragg peak and out of field (3). The field-defining aperture dominates as a secondary neutron production source because of its proximity to the patient, making the neutron dose dependent on the ratio of field size to aperture opening (4). The out-of-field patient neutron dose increases with beam range/energy and treatment volume (4, 5). Active and modulated scanning systems do not require scattering devices in the treatment head or patient apertures; as a result, the secondary neutron production in the treatment head is reduced, the majority of neutrons being generated in the patient's body (3, 4, 6). Because the devices' resets are due to the scattered neutron production and are random events and do not correlate to the total delivered dose, patients with CIEDs receiving PBT can potentially be treated in the same way as those patients receiving high-energy photon therapy (E > 10 MV), as suggested by Hurkmans et al (7) and Makkar et al (8).

In conclusion, I would like to commend the authors for contributing this institutional study and analysis to the limited literature on this subject.

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