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Measuring Pacemaker Dose: A Clinical Perspective

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Purpose

The number of patients presenting with pacemakers in our clinic has increased recently. Following AAPM recommendations, a treatment plan is developed that minimizes the dose to the pacemaker. The most efficient way to measure in vivo dose during treatment is to use MOSFETs or diodes which offer a simple but inaccurate (up to 25% error) method of recording. In this abstract, we analyze the dose measured by these different devices in an attempt to assess pacemaker dose.

Method and Materials

Five patients with different disease sites and pacemakers were chosen. To simulate the treatment delivery, a Rando phantom was placed on the table in the patient treatment position. An ion chamber was taped to the phantom under 1 cm bolus. Two MOSFETs and a diode were placed on top of the bolus and the treatment was delivered. One cone beam CT was obtained where the pacemaker was in the field-of-view to quantify the MOSFET and diode reading in this situation.

Results

The measurement from the ion chamber agreed well with the predicted dose from the planning system. Some errors resulted from misalignment of the phantom and ion chamber. Both the MOSFET and diode measurements agreed with the ion chamber and TPS with greater distances. Dose from CBCT was overestimated for both MOSFETs and diodes.

Conclusion

The simplest and most efficient in vivo measurement is to use a MOSFET or diode. When the pacemaker is more than 20 cm from the field edge these dosimeters are appropriate. When the field is less than 20 cm away, the most accurate although inefficient method is to use an ion chamber since there is little angular or energy dependence unlike diodes or MOSFETs. Another solution would be to use TLDs or OSL dosimeters although these are not simplistic dosimeters either.