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The calculated risk of fatal secondary malignancies from intensity-modulated radiation therapy.

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Abstract

PURPOSE: Out-of-field radiation doses to normal tissues may be associated with an increased risk of secondary malignancies, particularly in long-term survivors. Step-and-shoot intensity-modulated radiation therapy (IMRT), an increasingly popular treatment modality, yields higher out-of-field doses than do conventional treatments, because of an increase in required monitor units (beam-on time).

METHODS: We used published risk coefficients (NRC Report 116) and out-of-field dose equivalents to multiple organ sites to estimate a conservative maximal risk of fatal secondary malignancy associated with 6 IMRT approaches and 1 conventional external-beam approach for prostate cancer.

RESULTS: Depending on treatment energy, the IMRT treatments required 3.5-4.9 times as many monitor units to deliver as did the conventional treatment. The conservative maximum risk of fatal second malignancy was 1.7% for conventional radiation, 2.1% for IMRT using 10-MV X-rays, and 5.1% for IMRT using 18-MV X-rays. Intermediate risks were associated with IMRT using 6-MV X-rays: 2.9% for treatment with the Varian accelerator and 3.7% for treatment with the Siemens accelerator, as well as using 15-MV X-rays: 3.4% (Varian) and 4.0% (Siemens).

CONCLUSION: The risk of fatal secondary malignancy differed substantially between IMRT and conventional radiation therapy for prostate cancer, as well as between different IMRT approaches. Perhaps this risk should be considered when choosing the optimal treatment technique and delivery system for patients who will undergo prostate radiation.

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