Correspondence

Comment on "IMRT should not be administered at photon energies greater than 10 MV" [Med. Phys. 34, 1877–1879 (2007)]

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To the Editor,

In the June issue of *Medical Physics*, Dr. Followill and Dr. Nüsslin took up the important issue of energy selection in the planning of intensity modulated radiotherapy (IMRT). Based on the assumption that an IMRT plan's monitor units will be greater by a factor of 3 to 9 than a corresponding conformal plan, these gentlemen capably argue for and against the use of beam energies above the practical neutron production threshold.

Despite the high quality of their answers, we must remember that an answer's quality is sometimes less important than the quality of the question. Neutrons are not the sole source of incidental dose to patient structures distant from the target volume. While neutron production monotonically increases, past a threshold, as beam energy increases, the energy dependence of photon head leakage, patient inscatter, and modifier scatter depend in a more complicated way on beam energy as well as on other factors. The relationship between incidental patient dose and monitor units, however, is quite simple. If you double the monitor units, you double the dose. Letting the authors' arguments stand, it seems important to reverse the question to which they responded. Instead of assuming that excessively high monitor units will routinely be used to treat IMRT, we could more reasonably assume that high photon beam energies will be used, and should be used, to treat deep-seated target volumes. That being the case, the better question becomes "is it acceptable to allow the routine use of aggregate monitor units exceeding that of a corresponding conformal plan by a factor of 3 to 9?"

Consider the specific example of prostate IMRT. An anterior conformal hemi-arc with three forward-planned step-and-shoot beams (three to seven segments each) delivered using 20 MV photons [$\%DD(10\times 10, d=10)x=86.3$] can produce a dose distribution that compares very favorably to that produced using other IMRT methods. A description of the planning technique has been submitted for publication and can be shared with interested institutions. This method only requires an aggregate machine setting within a factor of 1.5 of the prescribe dose, i.e., it will have a dose delivery efficiency of better than $\frac{2}{3}$ cGy per monitor unit. A dose delivery efficiency of $\frac{2}{3}$ is in line with typical wedge transmission factors and in line with the percent depth dose of a 6 MV beam at a depth of 10 cm, neither of which is controversial. But, it is much greater than the very low IMRT delivery efficiencies posited by the authors.

So, is it the authors' beam energy or their planning method that is the cause for greater concern? Though secondary in importance to the target dose and to critical structure doses, incidental nontarget dose is relevant to radiotherapy treatment planning. The existence of neutron contamination is a well-understood property of beams with energies greater than 10 MV. But, it is not the only factor in determining incidental dose, just as incidental dose is not the only factor in determining the quality of an IMRT plan. It would be a mistake to behave otherwise.

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