Clinical Implementation of Task Group 43 Dose Calculations for Revised Source-Strength Standards and New Sources

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Implementation of the Task Group 43 dose-calculation formalism for Pd-103 and I-125 brachytherapy sources is complicated by the (i) implantation of a new primary air-kerma strength (S_K) standard at the National Institute of Standards and Technology (NIST) on 1 January 1999 and the appearance of many new source designs not addressed by the original TG-43 report. This talk will describe procedures for safely and accurately adapting to these changes.

For I-125 sources, the procedures are straightforward and well understood

(a) Revise the prescribed dose to compensate for the differences between pre-TG43 and TG43 dose calculations:

Adopting TG-43 dose distributions for treatment planning using sources available before 1999 or using critically reviewed dosimetry data for new I-125 sources, will result in calculated doses that are 10% to 18% smaller than doses calculated in the pre-TG43 era. To avoid increasing dose actually delivered to patients upon acceptance of TG43 dosimetry, the prescribed dose must be lowered by a corresponding factor which depends on the implant geometry, dose calculation algorithm, and pre-TG43 dosimetry data assumed by the accumulated clinical experience guiding the physician. Fortunately, pre-TG43 era dosimetry practices were quite uniform. For TRUS-guided definitive I-125 brachytherapy of prostate tumors, the revised dose should be lowered by 10% from 160 Gy to 145 Gy. For new sources, users should insist that TG43 data derived from at least two independent published dosimetry studies be available and that vendor calibrations be traceable to NIST's new S_K standard.

(b) Adapting NIST's new standard

For I-125 seed products marketed prior to 1 January 1999 (Nycomed Amersham and North American Scientific, Inc. products), the TG43 dose-rate constants, Λ, were normalized to NIST's 1985 standard. When these vendors adopt the revised NIST 1999 calibration standard, the user must increase Λ (or its equivalent) by 11.5% but should not modify the prescribed dose. Dosimetry data published for sources introduced to the market after January 1 1999, will be traceable to the 1999 standard and will not require correction.

For Pd-103 interstitial seeds, dose prescription changes will probably be needed for all sources. For the one source available before 1999 (Theragenics Model 200), the Λ value published in TG43 report will also require revision following implementation of a NIST-traceable S_K standard for this source. Measurements and Monte Carlo calculations are underway to define the appropriate dosimetry constants for the model 200 seed. Identifying the magnitude of the prescribed dose change, which affects users of all Pd-103 products, is complicated by the possibility that Theragenics' internal pre-1999 calibration standard (which is not traceable to any S_K standard) may not have remained constant throughout its history. As of March 1999, $S_{K,Th}$ as inferred from Theragenics' apparent activity calibration, is only 80% of NIST's measured values. Hopefully, more definitive recommendations will be available soon.