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THE NEED FOR INTERNATIONAL STANDARDIZATION IN CLINICAL BETA DOSIMETRY FOR BRACHYTHERAPY

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Introduction: Beta radiation has found increasing interest in radiotherapy. Besides the curative treatment of small and medium-sized intraocular tumors by means of ophthalmic beta radiation plaques, intravascular brachytherapy has proven to successfully overcome the severe problem of restenosis after interventional treatment of arterial stenosis in coronaries and peripheral vessels in many clinical trials with a large number of patients. Prior to initiating procedures applying beta radiation in radiotherapy, however, there is a common need to specify methods for the determination and specification of the absorbed dose to water or tissue and their spatial distributions.

The IAEA-TECDOC-1274 Calibration of photon and beta ray sources used in brachytherapy (2002) [1] is a help for photon brachytherapy calibration. But, for beta seed and line sources, IAEA recommends well type ionization chambers as working standards which are far from measuring absorbed dose to water of the radiation clinically used. Although the application of such working standards seems to be more precise, large errors can occur when the medical physicist has to convert the calibration data to absorbed dose to water of the beta radiation emitted. The user must believe that the source is equally activated and that the manufacturer did not change the design and construction of the source encapsulation.

Method: With the DGMP Report 16 (2001) Guidelines for medical physical aspects of intravascular brachytherapy [2] a very detailed code of practice is given, especially for the calibration and clinical dosimetry of intravascular beta radiation sources.

As there is a global need for standardization in clinical dosimetry for intravascular brachytherapy utilizing beta radiation, the DIN-NAR, the German committee on standardization in radiology, task group dosimetry, has initiated an international adhoc working group for a new ISO work item proposal on the standardization of procedures in clinical dosimetry to guarantee reliable application of therapeutic means.

Results: The DGMP Report 16, being more stringent and consistent as the AAPM TG 60 Report (1999) [3], recommends the calibration of all intravascular brachytherapy sources in terms of absorbed dose to water at the clinically relevant distance of 2 mm (for intracoronary application and 5 mm for peripheral vessels). For each source, the calibration in terms of absorbed dose to water should be checked

- at P_{Ref} = 2 mm for all intracoronary sources,
- at P_{Ref} = 5 mm for all intraperipheral sources.

The DGMP Report 16 further recommends to measure complete distributions of the absorbed dose to water during first delivery while checking replaced sources by dose measurements at selected points only. The purity of the radionuclide can be checked at two points within the range (R) of the β radiation (e.g. at R_{50} and R_{75}) and the absence of photon contamination at a point in the brems-strahlung background (e.g. at R_{125}). The dose uniformity of the source should be checked at the radial distance of the calibration reference point, i.e. at 2 mm or 5 mm, at least three measuring points along a linear source and one point opposite to the calibration reference point.

The intent of this new DIN-NAR standardization project Clinical dosimetry for beta sources for intravascular brachytherapy is to review methods and to give recommendations for the calibration of therapeutic beta sources, a code of practice for clinical beta radiation dosimetry and guidance for estimating the uncertainty of the absorbed dose to water delivered. The standard will be confined to "sealed" radioactive sources such as single seeds, source trains, line sources, cylindrical and volume sources, plane surface sources and ophthalmic applicators for which only the beta radiation emitted is of therapeutic relevance. The topics will include beta sources and source data; calibration principles, primary, secondary, transfer standards and traceability; instrumental requirements, in phantom dosimetry, clinical dosimetry and dosimetric quality assurance; dose calculation and presentation of dose distributions; as well as dose specification and reporting. The document is geared to organizations wishing to establish reference methods in dosimetry aiming at clinical demands for appropriate small measurement uncertainties. Existing normative documents as well as the existing national recommendations, such as those from AAPM, DGMP, ESTRO, NCS, IAEA, or ICRU will be taken into account.

Conclusions: The bilingual DGMP Report 16 has found broad international acceptance as a guideline for medical-physical aspects of intravascular brachytherapy and has partly been taken over by other recommendations (ESTRO, AAPM TG 60 up-date). Based on these and other normative documents, the DIN-NAR project will prepare international recommendations. The results of its first meeting at Essen in March 2002 and further activities will be reported.

REFERENCES

[1] IAEA-TECDOC-1274. Calibration of photon and beta ray sources used in brachytherapy. IAEA Vienna (2002) in press.

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[3] AAPM TG60 Report. Intravascular brachytherapy physics. NATH R, AMOLS H, COFFEY C, et al., eds. Med Phys 26 (1999) 19-152.