



"Clinical implementation of dosimetry for molecular radiotherapy"

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Dosimetry as an element of radiation safety in nuclear medicine

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GRP INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

- Main Commission
- Committee 1: Radiation Effects
- Committee 2: Doses from Radiation Exposures
- Committee 3: Protection in Medicine
- Committee 4: Application of ICRP Recommendations.
- Committee 5: Protection of the Environment

Task Groups Working Parties

Committee 3:

Protection of persons and unborn children when ionising radiation is used for medical diagnosis, therapy, or for biomedical research. Assessment of the medical consequences of accidental exposures.

Dosimetry in nuclear medicine



We want to know the absorbed dose in all irradiated tissues/organs of interest.

- Administered activity
- Biokinetics
- **Dose calculations** (radionuclide decay, body geometry, organ volume, etc...)

The ICRP has very been active in relation to dosimetry for nuclear medicine diagnostics

... but

has not yet any specific publication or recent detailed advice on dosimetry for molecular radiotherapy.



Annals of the ICRP

ICRP PUBLICATION 53

Radiation Dose to Patients from Radiopharmaceuticals



ICRP Publication 53

Absorbed dose and Effective dose equivalent

120 radiopharmaceuticals

Annals of the ICRP

Volume 22 No. 3 1991

ICRP PUBLICATION 62

Radiological Protection in Biomedical Research

Includes Addendum 1 to Publication 53—Radiation Dose to Patients from Radiopharmaceuticals & Summary of the Current ICRP Principles for Protection of the Patient in Diagnostic Radiology

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Addendum 1 (in Publ 62)

Absorbed dose and Effective dose 6 new radiopharmaceuticals Age-related bladder voiding model List of effective dose values



(A third amendment)

feeding interruptions.

33 radiopharmaceuticals in current

use. Recommendations on breast

ICRP Publication 80 (Addendum 2)

10 new radiopharmaceuticals+ recalculations of 19 frequentlyused ones in Publ 53.

New! ICRP Publication 128



ICRP Publication 128



Radiation Dose to Patients from Radiopharmaceuticals: a Compendium of Current Information Related to Frequently Used Substances

ICRP PUBLICATION 128

2015

The ICRP has very been active in relation to dosimetry for nuclear medicine diagnostics

... but

has not yet any specific publication or recent detailed advice on dosimetry for molecular radiotherapy.

However,

a number of the Commission's publications stress the need to carry out dosimetry for molecular radiotherapy.

E.g. in ICRP Publications 106 and 128 (Radiation Dose to Patients from Radiopharmaceuticals (ICRP, 2008, 2015):

..., due to the need for **more detailed and patient-specific dosimetry and dose planning** in tumour therapy using radionuclides, the data are not intended for therapeutic applications of radionuclides.

(1) ... use of radiopharmaceuticals for therapy requires even more detailed and patient-specific dosimetry and dose planning, including both tumour and normal tissue. The data presented in this report are intended for diagnostic nuclear medicine and not for therapeutic applications.

(25) ... models and absorbed dose values presented are intended for use in diagnostic nuclear medicine and clinical research with radionuclides, and should not be used in radionuclide therapy.

(70) **therapeutic administrations** are routinely contraindicated in the case of pregnancy or breast feeding as they may result in very high fetal doses. In addition, beyond 10–13 weeks of gestation, the fetal thyroid may receive extremely high doses in cases of therapy using ¹³¹I-iodide.

But that is not enough ! What should and can ICRP do ?

ICRP C3 Work Plan

- 1. Patient doses from radiopharmaceuticals (for diagnostic use).
- 2. Secondary cancers in RT.
- 3. Ion beam radiotherapy.
- 4. Cone beam CT. 😽
- 5. Justification in asymptomatic individuals.
- 6. Occupational RP in brachytherapy.
- 7. Justification (general framework) (WP).
- 8. RP in therapy with radiopharmaceuticals (WP).
- 9. Occupational protection in interventional (WP).
- 10.Diagnostic reference levels (WP).

Need and reasons for an ICRP Publication related to therapy with radiopharmaceuticals

- The medical community does not have easy access to methods and protocols for the collection of biokinetic or dosimetric data.
- 2. Many centers do not have such methods available despite performing research in this area. This severely constrains development.

3. As quantitative imaging and dosimetry is seldom performed, many treatments are effectively given blind. Quantitative imaging and dosimetry should be the basis for treatment planning.

 It is essential to alert the community to the variation in patient kinetics at therapeutic levels of activity.

- 5. This information would help to guide the introduction of new radiopharmaceuticals, particularly with regard to the levels of activity given.
- Interest by the ICRP is expected to encourage acquisition and the publication of additional data in greater detail.

7) A further justification for the report is that the Euratom directive 97/43 states that: 'For all medical exposure of individuals for radiotherapeutic purposes exposures of target volumes shall be individually planned; taking into account that doses of non-target volumes and tissues shall be as low as reasonably achievable and consistent with the intended radiotherapeutic purpose of the exposure'. The term 'radiotherapeutic' specifically includes 'Nuclear medicine for therapeutic purposes'.(Health protection of individuals against the dangers of ionising radiation in relation to medical exposure: Council directive 97/43 EURATOM 1997).

This directive has been translated into national legislation in many countries, so that the absence of dosimetry-based treatment planning raises potential legal concerns.

WP on "Radiological Protection in Therapy with Radiopharmaceuticals"

Members:

- Yoshiharu Yonekura, Chiba, Japan (C3) (Chair)
- Sören Mattsson, Malmö, Sweden (Honorary co-chair)
- Wesley Bolch, Gainesville, USA (C2)
- Lawrence T. Dauer, New York, USA (C3)
- Corresponding members:
- Chaitan Divgi, New York, USA
- Darrell R Fischer, Richland, USA
- Glenn Flux, London, UK
- Makoto Hosono, Osaka, Japan
- Michael Lassmann, Würzburg, Germany
- Stig Palm, Göteborg, Sweden
- Pat Zanzonico, New York, USA

Points for discussion:

- 1) Individual dosimetry to plan the therapy. Dose planning before therapy.
- 2) Individual patient biokinetics. Test activities and pretreatment tracers.
- Quantitative measurement of whole body/tumor/organ, test activity and its time variation. Analysis of urine or blood samples.
- 4) An evaluation of how to scale-up to therapeutic activity levels.
- 5) Individual dose calculations. Dose calculation based on 3Dpatient images or patient-like phantoms using Monte-Carlo or analytical techniques.
- 6) Knowledge of dose distribution within organs and tissues and of dose rate.

(continued)

- 7) Written directives for the therapy. Same protocol for different hospitals and clinics for measurements of biokinetic data and for dosimetry
- 8) A formalism for the addition of doses from nuclear medicine therapy and external radiation therapy for patients receiving both treatments

Report "Radiological Protection in Therapy with Radiopharmaceuticals"

A complete draft by summer 2015 for review by C3 at the Seoul meeting in October 2015.

(A concise publication with practical guidance. Total length of around 100 pages or less. Not a full textbook, but rather recommendations.)

Target audience

- Medical specialists, clinicians, practitioners and prescribers/referrers
- Medical physicists
- Radiation protection officers
- Regulatory authorities.
- Medical and scientific societies.
- Industry.
- Patients.
- Other stake holders

Thank you for listening and for your contributions and ideas!

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IGRPINTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

Task Group on Radiation Dose to Patients from Radiopharmaceuticals Working Party on Radiological Protection in Therapy with Radiopharmaceuticals

Report outline Radiological Protection in Therapy with Radiopharmaceuticals

(A concise publication with practical guidance. Total length of around 100 pages or less. Not a full textbook, but rather recommendations.)

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