International Commission on Radiological Protection

Publication 140: Radiological Protection in Therapy with Radiopharmaceuticals

Publication

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2. Radiopharmaceutical Therapy Methods: Justification and Optimisation
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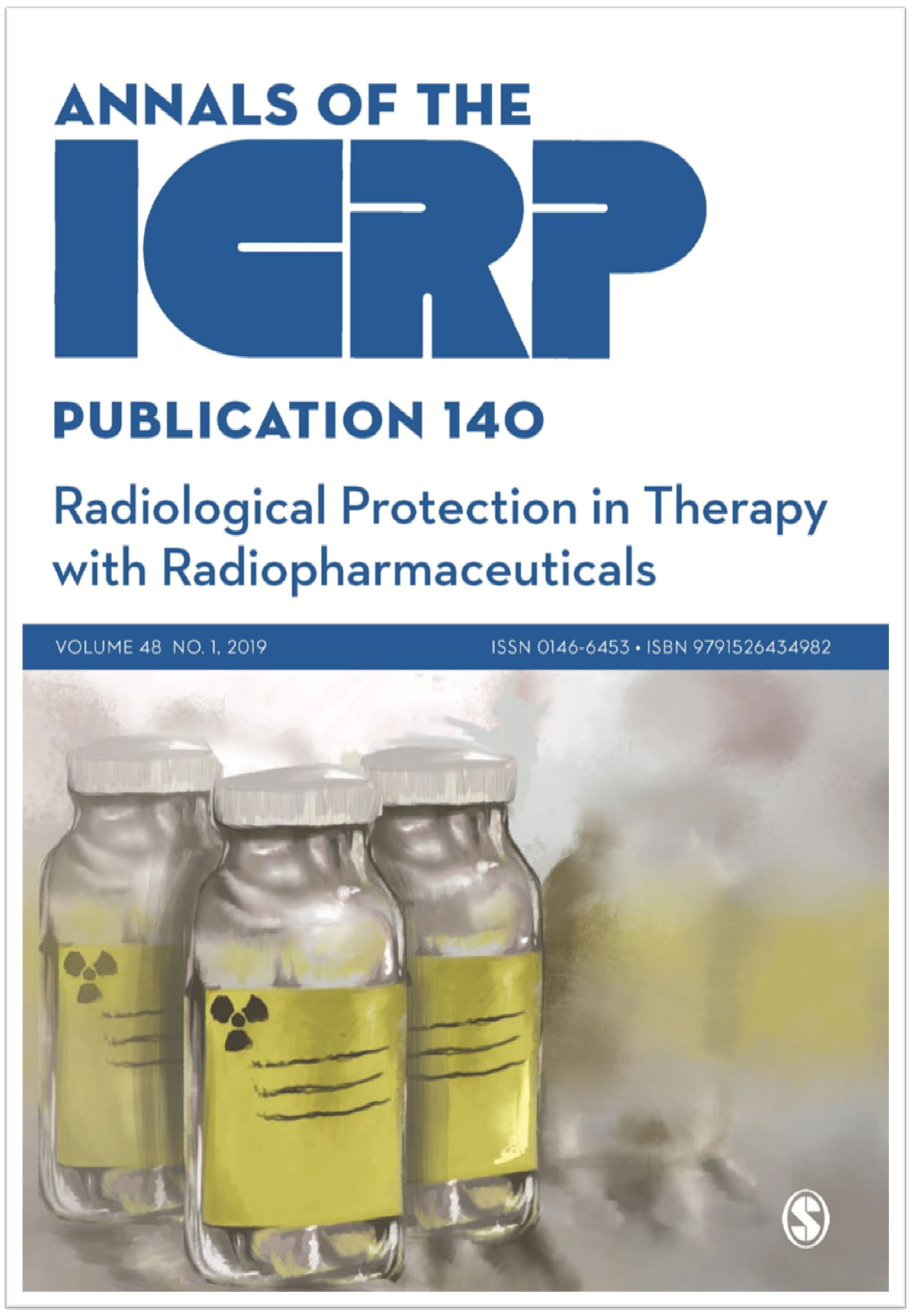
Abstract

Radiopharmaceuticals are increasingly used for the treatment of various cancers with novel radionuclides, compounds, tracer molecules, and administration techniques. The goal of radiation therapy, including therapy with radiopharmaceuticals, is to optimise the relationship between tumour control probability and potential complications in normal organs and tissues. Essential to this optimisation is the ability to quantify the radiation doses delivered to both tumours and normal tissues. This publication provides an overview of therapeutic procedures and a framework for calculating radiation doses for various treatment approaches. In radiopharmaceutical therapy, the absorbed dose to an organ or tissue is governed by radiopharmaceutical uptake, retention in and clearance from the various organs and tissues of the body, together with radionuclide physical half-life. Biokinetic parameters are determined by direct measurements made using techniques that vary in complexity. For treatment planning, absorbed dose calculations are usually performed prior to therapy using a trace-labelled diagnostic administration, or retrospective dosimetry may be performed on the basis of the activity already administered following each therapeutic administration. Uncertainty analyses provide additional information about sources of bias and random variation and their magnitudes; these analyses show the reliability and quality of absorbed dose calculations. Effective dose can provide an approximate measure of lifetime risk of detriment attributable to the stochastic effects of radiation exposure, principally cancer, but effective dose does not predict future cancer incidence for an individual and does not apply to short term deterministic effects associated with radiopharmaceutical therapy. Accident prevention in radiation therapy should be an integral part of the design of facilities, equipment, and administration procedures. Minimisation of staff exposures includes consideration of equipment design, proper shielding and handling of sources, and personal protective equipment and tools, as well as education and training to promote awareness and engagement in radiological protection. The decision to hold or release a patient after radiopharmaceutical therapy should account for potential radiation dose to members of the public and carers that may result from residual 9 radioactivity in the patient. In these situations, specific radiological protection guidance should be provided to patients and carers.



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