Introduction

There are several efforts ongoing that have produced software for three-dimensional treatment planning in nuclear medicine therapy. Treatment planning involves acquiring quantitative activity distributions at several time points, ascertaining time integrated activity in voxels, and computing absorbed dose distributions. There are several software suites that are designed to tackle this that have been produced by academic as well as corporate entities such as Philips Stratos (1) and GE Dosimetry Toolkit (2). Although many EANM and MIRD reports have been prepared that focus largely on activity quantification (3-9), the other aspects that translate distribution of activity to distributions of dose have received a lesser level of attention. Gold-standards that are agreed upon internationally are needed for therapeutic nuclear medicine. This is an opportunity to bring expertise from around the world to develop such standards. Accordingly, this report will focus particularly on the dose computation aspects of the problem and to a lesser extent on the activity quantification aspects of the problem.

Terms of Reference

The following tasks will be undertaken by the report committee and the results of these will be included in the report.

1. Articulate the need for treatment planning.
2. Describe the distinction between dosimetry for risk evaluation in diagnostic imaging and dosimetry for efficacy/toxicity evaluation in treatment planning for radiopharmaceutical therapy (RPT).
3. Define the elements of treatment planning for radiopharmaceutical therapy.
   a. Utilize existing reports as necessary (e.g. MIRD and EANM recommendations). This should facilitate keeping this section to a minimum.
5. Identify and evaluate available dose-response data
   a. from XRT
   b. from pre-clinical RPT studies
   c. from clinical RPT studies
6. Make recommendations for calculating 3D dose distributions.
   a. Applicability and recommendations regarding voxel-based S values to obtain 3-D dose distributions.
      i. provide tabulations of voxel S values for a limited number of radionuclides to establish gold-standard values.
      1. Include comparisons between several techniques.
      ii. discuss consequences of assuming point source distribution in voxels.
      iii. discuss consequences of dose averaging at the voxel level.
   b. Applicability and recommendations regarding Monte Carlo simulations to obtain 3-D dose distributions.
      i. Accuracy of different methods relative to voxel based approach
      ii. Importance of accounting for density differences vis-à-vis emission type
7. 3D EQDX distributions.
8. Recommendations on how treatment planning may be integrated into the development process for new RPTs.
9. Recommendations for future areas of study.
Timeline

The aim is to bring this report into a final draft by December 2017.

References