

Methods of mathematical modeling in modern diagnostic nuclear medicine

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Motivation and Aim: The methods of positron emission tomography (PET) and Single Photon Emission Computer Tomography (SPECT) are widely used for diagnostics in a modern medicine. The aim of this work is a developing of the mathematical modeling method in diagnostic nuclear medicine. The mathematical modeling and computer simulation are playing an increasingly important role in nuclear medicine.

Methods: Modeling of SPECT and PET imaging includes three basic components: 1) mathematical models of the activity distribution and attenuation map; 2) data acquisition models; 3) reconstruction algorithms and methods. In this work, the examples of modelling in nuclear cardiology, oncology and neurology are presented. Mathematical models describing the distribution of radiopharmaceuticals in a torso (cardiology), in a brain (neurology) and in a liver (oncology) were developed and used in numerical simulations.

Results: The results of numerical simulations in cardiology allowed us to understand the causes of apical artifacts in reconstructed images of myocardial left ventricle. The results of numerical modeling in oncology and neurology have demonstrated the possible directions for improving reconstruction algorithms and methods.

Conclusion: Mathematical modeling and computer simulations can effectively add clinical researches.

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