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Calculation of dosimetric parameters in paediatric phantoms using Monte Carlo techniques for 18F-FDG and the new TIAC

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Purpose: In nuclear medicine, one of the most used radiopharmaceutical is ^{18}F-FDG, administered in paediatric and adult patients considering the same time-integrated activity coefficient (TIAC). Although, the IAEA recommends specific paediatric dosimetry. The objective of this work was to estimate the absorbed dose per injected activity and effective dose per injected activity for the ^{18}F-FDG using two paediatric voxel phantoms (Baby and Child) using Monte Carlo techniques.

Methods: The radiopharmaceutical biokinetic data was obtained from the ICRP publication 128. Furthermore, the new TIAC values from a more recent publication were studied for the following organs: brain, urinary bladder wall, liver, heart wall, and lungs. The absorbed dose per injected activity (AD/IA) and effective dose per injected activity (E) values were calculated from the EGSnrc and MCNP6.1 for both phantoms and compared to the simulated data of pediatric voxel phantoms from the ICRP 128, MIRDcalc software, and available literature.

Results: Regarding AD/IA in organs, differences up to 61% and 115% were found for the Baby and 120% and 167% for the Child phantoms, respectively with ^{18}F-FDG. For the FDG using the new TIAC a maximum difference of 244% was found. For E the maximum differences were 27% and 31% respectively for Baby and Child phantom for FDG administered.

Conclusion: New specific pediatric dosimetric data has been computed by this study using reference phantoms for Baby and Child and newly recommended TIAC. The calculated data represent a contribution to the AD/IA gap in knowledge.

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