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Calculating internal dose by convolution from SPECT/MR fusion images

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A new computer program was developed to calculate the absorbed dose. The program is based on the use of the convolution method and abdominal SPECT/MR fusion images. The applicability of the method was demonstrated by using data from ^{111}In-labeled thrombocyte and ^{99m}Tc-labeled colloid studies of three healthy volunteers. Dose distributions in the volunteers and the average absorbed doses in liver and spleen were calculated. The average doses for ^{99m}Tc-labeled colloid study were 0.07 ± 0.02 (liver) and 0.046 ± 0.005 mGy/MBq (spleen). The results are in good agreement with a Monte Carlo (MC) based method (0.074 for liver and 0.077 mGy/MBq for spleen) used by the International Commission on Radiological Protection (ICRP). For ^{111}In-labeled thrombocyte study the doses were 0.33 ± 0.05 (liver) and 8.9 ± 1.2 mGy/MBq (spleen) versus 0.730 and 7.50, respectively. The differences in dose estimates in the ^{111}In-labeled thrombocyte study are mainly due to the approximation used in activity quantitation. Convolution of the activity distribution with a point dose kernel is an effective method for calculating absorbed dose distribution in a homogeneous media. Activity distribution must be aligned to anatomical data in order to utilize the calculated dose distribution. The program developed is applicable to and practical for clinical use provided that the input data needed are available.

Key words: internal dose, point dose kernels, convolution, SPECT/MRI fusion