Optimisation of administered activity for 18F-FDG examination on children

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Aim
The recommendations for administered activity stated in the EANM guidelines for ^{18}F-FDG examinations of children results in an effective dose of 6.7 and 7.5 mSv for 1 and 15 years old patients, respectively. This exceeds the effective dose given to adults with up to 40 %. Since children are more sensitive to radiation the aim of this study was to investigate if the effective dose can be reduced with preserved image quality for children undergoing ^{18}F-FDG examinations.

Methods
46 children, aged 2-19 years and with a weight range 11-116 kg, underwent ^{18}F-FDG examination on a GE Discovery 690 PET/CT. The patients were administrated with 3 MBq/kg or more and examined 60 minutes after administration with at least 4min/bed. Acquisition in listmode allowed studies for patients to be truncated to correspond to studies of an injected activity of 3 MBq/kg and an acquisition time of 3 and 4 min/bed, respectively.
Regions-of-interest were drawn in the liver. The SNR (signal-to-noise ratio) was calculated as the ratio of the activity concentration and the standard deviation. The SNR for the paediatric groups were compared with the SNR from 20 adult normal weighted patients (administered activity 4 MBq/kg, examined 60 minutes after administration, 2 min/bed) on the same camera and with same reconstruction parameters.

Results
Using an administered activity of 3 MBq/kg resulted in SNR=10.9 for children < 40kg and a scan time of 4 min/bed, and in SNR=10.6 for children > 40 kg and a scan time of 3 min/bed. The normal weighted adult patients had a mean SNR of 10.9. This results in an effective dose of 2.9 mSv for a 1 year old and 4.1 mSv for a 15 years old. The corresponding effective dose using EANM guidelines would be 6.7 mSv and 7.5 mSv. The new administration schedule gives a factor of 2.3-1.8 lower effective doses than the EANM guidelines recommendation.

Conclusions
Our result shows that it is possible to significantly reduce the administered activity and effective dose for 18F-FDG examinations of children with a preserved signal-to-noise ratio.