Comparison between motion corrected pinhole and parallel hole SPECT in 99mTc-DMSA studies

ABSTRACT 18

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Pinhole SPECT studies (PHS) were previously demonstrated to be of general better quality than parallel hole SPECT for Tc-DMSA studies. Motion correction is particularly challenging in renal pinhole SPECT, due the pinhole magnification that is strongly spatially dependent, unlike what happens in parallel hole collimation. We wonder if, after motion correction, the advantage of pinhole SPECT would still remain.
Six hours after a weight-dependant injection of 99mTc-DMSA, four 5min-dynamic views and two 25min-SPECT were performed in 25 patients (pts). On both SPECT imaging, the acquired projections were shifted to match as well as possible the re-projections of a first reconstruction of the set of good incidences only. Reconstruction of both SPECT was made with an OSEM algorithm with, in the case of PHS, geometric correction and adaptive filters.
Criteria for the visual comparison of both SPECT were the blurring of the contours, the cortex/cavity contrast and the depth and volume of the cortical defects. In case of doubt, the motion-corrected planar imaging was used as gold standard.
Compared to parallel hole SPECT, pinhole SPECT had a better quality of imaging in 13 pts, the same in 6 pts and a lower quality in 6 pts. A significant relation was observed with the registered counts for PHS: a large number of counts (i.e. above 150.000) is associated with a greater chance to be superior to parallel hole SPECT. The amount of registered counts is depending on the injected dose, the body attenuation and the kidney-pinhole distance. The superiority of PHS was thus clearer for patients with age between 2 and 18 years.
In conclusion, the difficulty to correct for motion in PHS doesn't preclude the superiority of this method on parallel hole SPECT for children. In adults, both techniques seem equal, probably due to the higher kidney-pinhole distance and attenuation.

Slower thyroid clearance of 99mTc -MIBI in case of Hashimoto's thyroiditis.

ABSTRACT 19

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Focal Hashimoto's thyroiditis is sometimes difficult to differentiate on scintigraphy using 99mTc-pertechnetate or iodine from other hypoactive lesions like carcinoma, cyst or some adenomas. The shape of the lesion obtained by pinhole SPECT (PHS) helps, but is not sufficient in this purpose. We investigate if 99mTc-MIBI, a cellular marker not directly related to endocrine secretion, could still improve the differentiation
We retrospectively studied 40 patients. Ten of them were suffering from extended Hashimoto disease at different stages, as proved by the clinical data (specially the time evolution) and the high amount of anti-thyroglobulin antibodies. The remaining 30 patients used as controls, had various thyroid pathologies, chiefly multinodular disease and cysts. Immediately after injection of 740 MBq of 99mTc-MIBI, 3 PHS of 5' each were successively performed. The PHS software uses an OSEM reconstruction algorithm and adaptive filters, and enables the absolute quantification of the reconstructed images. A Student t-test was used to compared in both series the value of the clearance index ((early SPECT –late SPECT)/ early SPECT).
The clearance index between the 1st and the 3th SPECT of the patients with thyroiditis (10.0%) was significantly lower ($p= 0.03$) than the control group (14.8%), also between the 1st and the 2nd SPECT (7.6 vs 11.6%; $p= 0.04$). We found no influence of the hormonal status in both series.
These preliminary results suggest a early clearance of 99mTc-MIBI slower than normal in patients suffering from Hashimoto disease, at least in its extended form. If this could be transposed to its focal form, than it could become a parameter of differential diagnosis. This also should be kept in mind in case of thyroid lesions with increasing activities of 99mTc-MIBI with time.

Lesion size effect on variability in PET quantification in multicenter trials

ABSTRACT 20

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Introduction
In multicenter trials, the various capabilities of different PET/CT systems impact the SUV quantification between centers. The lesion size is known to affect SUV. We performed a phantom study to assess its role in the inter-center variability of quantification.

Materials & Methods
The NEMA NU2-2007 phantom was used. The background was filled with 2.6 kBq/ml of 18F-FDG and the spheres (A=26.5, B=11.5, C=5.6, D=2.6, E=1.2, and F=0.5 ml in volume) with 3, 6 and 9 times the background activity.
Each center applied its routine acquisition and reconstruction settings.
The recovery coefficients (RC) were measured in spherical VOIs matching the phantom spheres.
We assessed the variability in quantification with: a. the coefficient of variation (CoV) in the RC distribution, b. the standard deviation (SD) in the distribution of SUV differences (ΔSUV) between two spheres of same volume and different contrasts. The RC's and ΔSUV were between two groups: the three largest (ABC) and the three smallest (DEF).

Results
The CoV for all contrasts and centers are 12.9% (group ABC) and 35.8% (DEF) (Levene's test: p<1e-5).
The SD for relative ΔSUV for 3 contrasts comparisons are:

	9 to 9	9 to 6	9 to 3
ABC	5.8	4.7	4.0
DEF	12.3	9.1	7.2

The difference is also significant (p<1e-5).

Conclusions
Our study shows that the well known lesion size effect on PET quantification can be reduced to an acceptable level of variability in a multicentre setting, even with poor knowledge of the lesions volume. This can be achieved both for RC and ΔSUV by considering only lesions with a size above 2 cm.

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F-18 FDG PET, MRI or PET/MRI: which method is best for discriminating high-grade from low-grade gliomas?

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Aim
To investigate which of 5 methods - visual interpretation of PET images at conventional and delayed intervals, MRI and PET/MRI or SUV calculation at the site with the highest tumour grade according to MRI - is best for differentiating high-grade from low-grade gliomas.

Methods
Twenty-five patients with gliomas undergoing a stereotactic biopsy underwent PET scanning at conventional and delayed intervals, and multimodal MR examinations. On the PET, MR and PET/MR images, tumours were visually classified in 5 categories (definitely high-grade, probably high-grade, inconclusive, probably not high-grade, definitely not high-grade). SUV of the voxel with the highest tumour grade according to MRI was calculated. Validity of the visual reading and the quantitative approach, this is SUV calculation, was investigated by performing a receiver-operating-characteristic (ROC) analysis with the pathological diagnosis as the gold standard.