k3, k4) were estimated using Kinetic Imaging System developed at our laboratory. The K FLT uptake constant was defined as K1*k3/ (k2 +k3). During dynamic scanning, serial micro-blood samples (8-10µl, 12x1min, 5x10min) were collected with capillary tubes after pricking tail vessels and then assessed with gamma well counter. Input function from image-based analysis correlated well with that from blood-sampling method. (r-square =0.95). K FLT uptake values from images alone and image-blood sampling hybrid method were 0.046$\pm$0.005 and 0.050$\pm$0.007, respectively (p>0.5). Image-derived analysis is ideal for extraction of input function. However, when blood sampling is mandatory in mouse studies, tail vessel blood collection with its easy access and comparable accuracy may substitute for the arterial sampling that can only be accomplished with microsurgery.

No. 206

EVALUATION OF CURVE FITTING METHODS USED IN COMPARTMENTAL MODELING

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Objectives: To assess the confidence in fitted parameters resulting from compartmental modeling of positron emission tomography (PET), single photon emission computed tomography (SPECT), Dynamic Contrast Enhanced- magnetic resonance imaging (MRI)
or computed tomography (CT) studies, performance of two curve-fitting methods: Levenberg-Marquardt (LM) and MINPACK-1 (MP) was investigated. The speed, global convergence failure rate and accuracy of the fitted parameters were evaluated and compared. Methods: Based on a two-compartment model, each method was applied to two data sets: i) time-activity curves (TAC) were simulated using combinations of kinetic parameters covering a range of physiological values. Different levels of Gaussian noise were added and repeated 100 times for each TAC. ii) A dynamic 2-deoxy-2-[F-18]fluoro-D-glucose (FDG)- positron emission tomography (PET) brain dataset was simulated using PET-SORTEO with typical rate constants. Voxelwise fitting of TACs from gray and white matter regions simulated parametric mapping under realistic PET image noise. Starting points for the algorithm search were generated randomly in parameter space and non-negativity constraints for each kinetic parameter were applied. Success of global convergence was defined by comparing to chi-square values obtained from known parameters. Results: MP was four times faster than LM. For the first data set, the averaged failure rate at different noise levels ranged 2-10.6% (MP) and 30.6-41.6% (LM) for parameters close to zero, and 0.3-0.4% (MP) and 5.2-6.3% (LM) in other cases. For the second data set, the failure rate was 0.04% (MP) and 3% (LM). The fitted parameters showed bias and varying deviation indicating a poor fit to Gaussian distribution. Conclusions: MP significantly outperformed the LM method. Using multiple search starting points reduced the failure rate.

No. 207

ONE CLICK ALIGNMENT AFTER SMALL ANIMAL ILL-POSITIONED ACQUISITION

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Introduction: Small animal studies are not always acquired in perfectly controlled conditions. This leads to reconstructed images that sometimes are ill-positioned: the animal is rotated or translated from the expected position. The study must be reoriented using a manual reformatting tool until the result has the desired orientation or position.
To avoid this manual step, we propose a totally automatic procedure making use of the image principal axes and centroid, combined with an auto-registration process. The result is a correctly positioned study. Materials and Methods: For every study, the centroid is translated to the image center, locating the image in the middle of the Field of View. Due the left-right symmetry in the transaxial plane, only the principal axis with bigger eigenvalue is used to align the image. Thus this axis becomes aligned with the image Z direction. Finally, to correctly solve the orientation in the transaxial plane, the transformed study is co-registered with a mirrored version. The result has the left-right symmetry plane in the saggital plane, and consequently the transaxial plane becomes correctly aligned. Results: The method has been tested with 15 PET rat brain images, and the result has been validated by an expert user. All images were correctly aligned with no user intervention. This algorithm corrects ill-positioned acquisitions and aligns the studies to a common orientation very quickly and with no user intervention.

No. 208

AUTOMATIC PRE-ALIGNMENT OF MULTIMODALITY RAT BRAIN IMAGES USING PRINCIPAL AXES TRANSFORMATION

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Introduction: The use of small animal studies of different modalities is nowadays widespread, since functional studies like positron emission tomography (PET)
or single photon emission computed tomography (SPECT) are better analyzed when mapped to the underlying anatomical structure coming from magnetic resonance imaging (MRI) or computed tomography (CT). The different positioning of the animals in the scanners results in the need for automated image registration methods. One important drawback of the existing algorithms is their limited capture range: if case of large initial misregistration (large translations and rotations) the optimization may not converge to the right solution, and the images do not become correctly co-registered. To avoid this problem we propose the use of a pre-alignment step based on the principal axes transformation. Materials and Methods: To test this approach we acquired three rat brain image pairs from different modalities: CT with 2-deoxy-2-[F-18]fluoro-D-glucose (FDG)-PET, MR with FDG-PET and MRI with alpha-methyltyrosine PET. These studies were co-registered using external markers, being the resulting transformation our gold standard. 100 random transformations were applied to every co-registered pair to provide different values of know initial misregistration. The images were realigned by Normalized Mutual Information with Powell optimization using or not the pre-alignment step. Results: Automatic registration method alone provided good results (>85% success) when initial misalignment did not exceed 10 mm in translation and 15º in rotation, but not more than 30% of success was achieved for larger initial misalignments (up to 20 mm and up to 45º). On the contrary, when using the pre-alignment step the proportion of successful registrations increased noticeably (> 70%).

No. 209

MULTIMODALITY WORKSTATION FOR SMALL ANIMAL IMAGE VISUALIZATION AND ANALYSIS

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Small animal studies of different modalities require certain image processing tools to be properly visualized and analyzed. We present a multimodality workstation that performs these tasks for different image modalities: positron emission tomography (PET) and computed tomography (CT). Different import formats are accepted (RAW, Interfile, Analyze, DICOM) and also exported. The animal studies can be displayed in different ways, providing always a tri-planar viewer that shows transaxial, coronal and sagital views synchronized. Several basic tools are always available, like window/level and color table setting, image reformatting (affine transformation), distance and angle measures or line profiles. Analysis module allows segmenting three dimensional Regions of Interest (3-D ROIs) using not only manual but also semi-automatic methods like thresholding and region growing. The system calculates several parameters for the resulting ROIs like volume, total and mean activity or temporal curves in case of dynamic studies. Registration module focus on image fusion: Manual registration methods depending on 3-D