No. 128

PATIENT MOTION COMPENSATION FOR RENAL SCINTIGRAPHIC STUDIES BY A FAST CORRELATION IMAGE REGISTRATION METHOD.

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A computer method has been developed to compensate for patient motion which is a serious problem in renal scintigraphic studies. The long acquisition time of a renal dynamic study (approx. 25 minutes) makes it very difficult for both adult and pediatric patients to remain immobile. Visual appreciation of the sequential images may be severely affected by patient motion and the quantitative computer analysis produces erratic renograms due to random changes of the selected anatomical sites (ROIs). As such, the interpretation of renal scintigraphic studies with patient motion may not be possible and often have to be repeated.

The developed computer method compensates for translational and rotational differences between images acquired while the patient was not moving and images acquired after the occurrence of motion. The fast correlation image registration algorithm accomplishes decoupling, calculation and subsequent correction of the registration variables - translation and rotation - as follows: First, the Fourier magnitude of each image to be registered is obtained in order to decouple translation from rotation by effectively centering the information content of each image. The resulting Fourier magnitudes, which are translation-invariant, are transformed to polar coordinate representation, r and Θ, which converts rotation into a cyclic shift along the Θ-coordinate. The two-dimensional cross-correlation function (cyclic in Θ, linear in r) is then calculated. The position of the maximum determined along the zero r profile of the cross-correlation function specifies the optimum rotation angle between the images. Next, one of the original images is rotated appropriately, and is cross-correlated with the other original image. The maximum of this cross-correlation yields the optimum translation parameters. The algorithm proceeds through all images with motion and the appropriate compensations take place. The corrected series is thus available for ROI placement and renogram generation.

The method was applied successfully to 25 clinical cases with patient motion (both native and transplanted kidneys). This computer method is a very useful clinical tool for salvaging renal scintigraphic studies with patient motion, thus preventing erroneous interpretation or repeat of the examinations.