Faisability and quantitative impact of the use of a FDG PET/CT respiratory gating method using HD Chest without increasing acquisition time, in a daily practice

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Résumé

Introduction:
Respiratory motion in FDG PET/CT induces blurring images, leading to errors in tumor location and in lesion quantification, especially for lung and upper abdominal lesions. To avoid these artefacts, various respiratory gating methods have been developed and most of current PET/CT scans are equipped.

However, these methods are not routinely used especially because they are time-consuming. The aim of the study was to assess the faisability and the quantitative impact of the use of a respiratory gating method using HD Chest without increasing the acquisition time in all patients referred for a FDG PET/CT in daily practice.

Methods:

All patients referred for whole-body FDG PET/CT were prospectively enrolled. Two sets of images were analysed: standard free-breathing FDG PET/CT images (1mm/s speed, Siemens Biograph mCT flow), and respiratory gating images without changing acquisition time (data were stored in list-mode during standard acquisition, computer automatically kept 35%, 40% and 50% of the counts between 2 determined thresholds). Analysis was done in patients with lung or upper abdominal lesion, other patients were excluded. Contrast to noise ratio (CNR) in each set of gating images was compared to find the best compromise between respiratory blurring correction and count rate. SUVmax, SUVmean, metabolic tumour volume (MTV) were recorded and compared. A 4D reconstruction was performed to measure the displacement of the lesion, and a relative value according to its size was calculated to categorize the results. All results were expressed as mean values of the percentage differences ± standard deviation compared to non-gated data.

Results:

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Between October 1st and December 31st, 2016, 775 patients were refered to our medicine department for FDG PET/CT examinations. 643 were excluded: technical problem or non compliant patient in 34 cases, 523 patients did not have lung or upper abdominal lesion, in 86 patients respiratory gating images were not usable. Analysis was finally performed on 132 patients (17%). No significant improvement was found in the 40% and 50% reconstructed data regarding to the CNR measure. The 35% reconstructed data were used for the second analysis. SUVmax, SUVmean and MTV changes were respectively 14% ±10, 10% ±7 and -13% ±11 for lesion with a relative displacement less than 80 % and respectively 36% ±12, 40% ±10 and -35% ±10 for lesion with a relative displacement more than 80 %.

Conclusion:
The use of HD Chest without increasing acquisition time is feasible in daily practice, using 35% reconstructed data and has a quantitative impact for lung or upper abdominal lesion with a significant displacement according to its size.