Qualification of PET-CT scanners for use in SAKK 56/07 multicentre trial

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Introduction

Our PET Core Laboratory qualifies sites to participate in an oncologic multicenter trial assessing therapeutic response with hybrid PET/CT performed for the Swiss Group for Clinical Cancer Research (SAKK) in Switzerland (n = 6) and France (n = 4). Each site must meet entry criteria before the first patient enrolment and accuracy of scanner SUV calibration verified. The PET Core Laboratory quantitatively reviews PET images of uniform phantoms submitted by each centre. This validation is crucial to ensure that changes observed during therapy actually correspond to real changes. Precise and accurate determinations of SUV are a prerequisite for any multicenter trial.

Materials & Methods:

In order to qualify for participation, each PET centre had to submit a PET/CT dataset from a water-filled uniform phantom containing 40-55 MBq (6283 mL) or 80 MBq (9293 mL) of F-18-FDG scanned according to each centre's standard oncologic protocol. The activity of the phantom has to be determined precisely by measuring the syringe activity before and after injection in a dose calibrator. The average standardized uptake value (SUV) and standard deviation (SD) should be measured in the reconstructed image along all transverse slices. The expected SUV should be 1.00 g/mL in all slices with acceptable values ranging from 0.90 to 1.10 g/mL to accommodate possible variations of SUVs across PET scanners and institutions.

Results:

The average SUVs for uniform cylinder images for the different scanners evaluated are reported in the Table. In total, 13 PET scanners in 10 participating centres performed these uniform phantom measurements and 1/13 (8%) did not qualify for study participation. This last centre performed manufacturer's maintenance of its PET/CT and the measurements were subsequently within acceptable SUV ranges.

Table. Uniform Phantom Mean SUVs vs. Scanner Model (g/mL)

Scanner Model	Mean±SD	Range before inclusion	Range after recalibration
GE Discovery (n=6)	0.99 ± 0.08	0.91 – 1.15*	0.91–1.10
Siemens Biograph (n=5)	1.02 ± 0.07	0.93 – 1.06	–
Philips Gemini (n=2)	0.98 ± 0.08	0.90 – 1.03	–

*The centre with out-of-limit SUV was notified and performed manufacturer's maintenance, including a recalibration of the PET/CT.

Discussion

Minimizing methodological errors in SUV measurement is critical to achieve accurate quantification, which is of utmost importance in multicenter clinical trials. Our results show that SUV accuracy must be verified in each centre, and that all centres are able to qualify for accurate SUV calibrations after additional recalibration. The stability of SUV values would also need to be verified by periodic assessment of SUV calibration during the whole trial duration.