EARL FDG-PET/CT accreditation program: feasibility, overview and results of first 55 successfully accredited sites

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INTRODUCTION
• **Many factors affect SUV (Fig1.) quantification of FDG PET/CT studies (overview of factors).**

• **Multicenter quantitative FDG PET/CT studies are hampered by variability in applied methodology resulting in large inter-institute SUV differences (Fig.2).**

• **To this end the EANM published the European guideline for PET tumour imaging with FDG (Boellaard et al., EJNMMI 2010).**

• **EARL accreditation program, endorsed by EANM and EORTC, was started in 2010 to implement this guideline. So far, 65 PET/CT systems across Europe are accredited**

OVERVIEW OF FACTORS AFFECTING FDG PET/CT SUV QUANTIFICATION
Technical factors*
  • Relative calibration between PET scanner and dose calibrator (10%)
  • Residual activity in syringe (5%)
  • Incorrect synchronisation of clocks (10%)
  • Injection vs calibration time (10%)
  • Quality of administration (50%)

Physics related factors*
  • Scan acquisition parameters (15%)
  • Image reconstruction parameters (30%)
  • Use of contrast agents (15%)
  • Region of interest definition (50%)

Biological factors*
  • Uptake period (15%)
  • Patient motion and breathing (30%)
  • Blood glucose levels (15%)

*Percentages between brackets indicate typical (largest) effect on SUV result.

R. Boellaard 2009, J Nucl Med Supplement Issue 50: 11S

$$SUV_{TBW} = \frac{PET\ [kBq/ml]}{FDGDose[MBq]/weight[kg]}$$
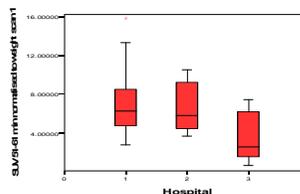
Figure 1: Standardised uptake value (SUV).

Figure 2: Baseline SUV data from 3 different institutes, showing large variability in SUV results between sites 1 and 2 versus 3: the latter not meeting the guideline standards.

EANM FDG PET/CT GUIDELINE ESSENTIALS
The EANM FDG PET/CT guideline for tumour imaging handles various factors influencing SUV by giving strict recommendations for:
  • Patient preparation
  • FDG dosage as function of weight and scanning time
  • PET acquisition
  • PET image reconstruction
  • Data analysis
  • Quality control (QC) procedures

Important aspect is use of **harmonising** performance standards.

EARL (EANM Research Ltd) ACCREDITATION PROGRAM
Harmonising performance QC standards: minimises differences in image quality and qantification between sites.

QC aims at
Verification of PET/CT system calibration using uniform cylinder.
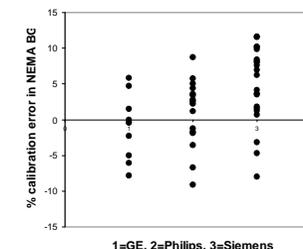Verification of SUV recovery and image quality using modified NEMA NU 2 phantom.

RESULTS

1=GE, 2=Philips, 3=Siemens

Figure 3: Results of calibration QC as function of PET/CT system.
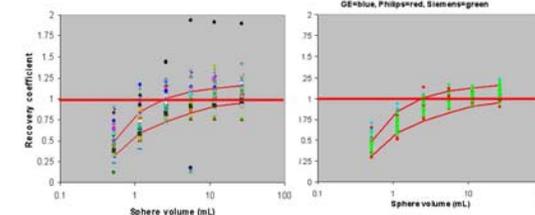

GE=blue, Philips=red, Siemens=green

Figure 4: SUV recovery coefficients observed using the image quality QC before (left) and after (right) accreditation. The large variability in SUV performance can be reduced to within EARL harmonizing criteria by the accreditation program.

CONCLUSIONS
• The EARL FDG PET/CT accreditation program is feasible and is successfully running.

• Accreditation is essential to obtained harmonized quantitative scanner performance (Figure 4).

• At present more than 75 systems have been accredited.

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