Variations of clinical PET/CT operations for oncology imaging: An international web-based survey

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Conflict of interest

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- LS Freudenberg
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- J Czernin
  Stockholder Sofie Biosciences, Momentum Biosciences, Advisor to cmi-experts GmbH, Zurich, CH

NONE
Clinical PET/CT

Delbeke et al. JNM 47 2006

Krause et al. Nuklearmedizin 46 2007

Boellaard et al. EJNMMI 37 2010

Routine PET/CT operations governed by guidelines
Large variability among academic centres
Injected activity, fasting time, diet and exam parameters

Need for standardization of methodology (cf HTA)
Motivation

- To assess clinical PET/CT operations worldwide
- To reflect professional experience with PET and PET/CT
- To review imaging protocols for FDG-PET/CT studies
- To cross-reference protocol variabilities to guidelines
Methods

▪ Survey: 58 questions
  - Demographics: Professional background, countries, regional factors
  - Operations: Experience, no. systems, tracer production, indications
  - Imaging protocol: Routine FDG-PET/CT oncology studies

SurveyMonkey.com
Link distributed via AMI mailing list from 11/2009 – 04/2010
Results - Demographics

% Responses per geographical region

14% response rate. Mainly from the US and Europe.
Results - Demographics

- PET/CT governance
  - Public: 60%
  - Private: 33%
  - Public/Private: 7%

Most sites with 1-2 PET/CT and prior clinical PET experience
Results - Demographics

- How many employees are actively involved in PET/CT operations?

<table>
<thead>
<tr>
<th>Role</th>
<th>FTE/y</th>
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<tbody>
<tr>
<td>Tech</td>
<td>4.9</td>
</tr>
<tr>
<td>Rad-MD</td>
<td>3.8</td>
</tr>
<tr>
<td>Nuc-MD</td>
<td>2.5</td>
</tr>
<tr>
<td>PhD</td>
<td>1.3</td>
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More technologists than MD and PhD per PET/CT site
In how many patients (%) are the following tracers used?

- FDG: 100%
- DOTATOC: 9%
- Choline: 24%
- FET: 14%
- 124I: 5%
- 18F-: 30%
- Acetate: 6%
- DOPA: 17%
- Other: 34%

Other tracers:
- $^{11}$C-PIB, $^{13}$N-ammonia, $^{15}$O-water, $^{18}$FACBC, $^{18}$FMISO, $^{18}$FLT, $^{18}$FPCIT, $^{68}$Ga RGD, $^{82}$Rb
Results - Operations

- Which are the most frequently performed patient examinations?

Main indications
1. Oncology  Lymphoma, lung cancer, breast cancer
2. Cardiology  Viability
3. Neurology  Dementia diagnosis

Mainly torso-oncology imaging. Shift to special applications.
Results – Imaging Protocol

- What is the average fasting period (h) prior to FDG-PET/CT?

- What is the blood glucose level cut-off point (mg/dl)?

Major variations: Fasting and Blood sugar level cut-off
Results – Imaging Protocol

Please define co-axial anatomical limits for a torso PET/CT exam.

Note, variations in upper limit translate into variations of lower limit (integer number of PET bed positions).

Major variation: Upper co-axial imaging range (± 10 cm)
Results – Imaging Protocol (CT)

- Do you use a dedicated low-dose, non-enhanced CT for CT-AC?
  - 73% yes

- In how many patients (%) do you employ IV or oral CT contrast?

Low-dose CT-AC prevails. More oral than IV contrast.
Results – Imaging Protocol (PET)

- Do you perform patient weight based administration of tracer activity?
- If no, then please give the absolute activity for a standard 75 kg patient.

- What is the FDG uptake time?

Major variations: Injected activity and FDG uptake time

- 44% yes
- 5.2 (1.5 – 7.8) MBq/kg
- 2D: 524 (370-670) MBq
- 3D: 465 (200-740) MBq

<table>
<thead>
<tr>
<th>% sites</th>
<th>0-45</th>
<th>46-60</th>
<th>61-75</th>
<th>76-90</th>
<th>&gt;90 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>8%</td>
<td>60%</td>
<td>11%</td>
<td>20%</td>
<td>1%</td>
<td></td>
</tr>
</tbody>
</table>

- 1%
Who is PET/CT reporting done by?

- 60% sites have Nuc Med MD
- 21% sites have Rad MD
- 23% sites have Nuc Med MD + Rad MD
- 37% sites have Double certified MD

17% sites generate fully separate PET and CT reports!

Individual or separate reporting and reports rather popular.
Results – Imaging Protocol (Reporting)

- Do you measure and report SUV?

90% yes

- Which SUV parameters do you report?

- Do you use SUV for treatment response descriptions?

91% yes

$\text{SUV}_{\text{max}}$ used in diagnosis, staging and follow-up
Discussions

- Eligible response rate of 14% is acceptable
- PET/CT clinically established, multiple systems on site
- Mainly $^{18}$F-based tracers for oncology imaging
- Major variations in oncology imaging protocols
  - Patient preparation, injected activity and uptake time
  - Definition of imaging ranges and acquisition parameters
  - Use of CT contrast agents
- High fraction (17%) of fully-separate reports
Conclusions

- Major variations in clinical FDG-PET/CT operations
- Guideline variations encourage protocol variations
- Onset of standardization efforts must be supported
- Need for continuous (cross-specialists) training

Revised guidelines with minimum variations in key parameters
Acknowledgement

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