Anxiety in patients undergo PET/CT scanners: causes, levels, and prevention

Lina Vieira¹,², Ana Filipa Pires¹ & Ana Grilo¹,³

¹Escola Superior de Tecnologia da Saúde de Lisboa, Instituto Politécnico de Lisboa, Lisboa, Portugal
²H&TRC-Health & Technology Research Center, ESTeSL- Escola Superior de Tecnologia da Saúde, Instituto Politécnico de Lisboa, Lisboa, Portugal
³Centro de Investigação em Ciência Psicológica, Faculdade de Psicologia, Universidade de Lisboa. Lisboa, Portugal
1. Introduction

Emission

/G Patient’s body

Gama Câmara  SPECT  PET
Simple Photon Physical collimator
2 photons Eletronic collimation

Source: Nuno Chichorro, 2018
In order to get a PET image, a radiopharmaceutical is administered to the patient. The administration of this radioactive compound will cause instability in the nucleus of the patient’s cells.
Despite being very useful in many clinical areas, PET imaging mostly contributes to the following areas:
1. Introduction

1.3. Radiopharmaceuticals used in PET in oncological situations

<table>
<thead>
<tr>
<th>Medical Field</th>
<th>Radiopharmaceuticals</th>
<th>FDA approval</th>
<th>EMA approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oncology</td>
<td>18F-FDG (Fludeoxyglucose)</td>
<td>2000 – cancer applications</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>68Ga/18F-PSMA (prostate specific membrane antigen)</td>
<td></td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>18F-Fluciclovine</td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td>68Ga-DOTA-conjugated peptides (DOTA-NOC, DOTA-TOC and DOTA-TATE)</td>
<td></td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>18F-FDOPA (Dihydroxycphenylalanine)</td>
<td>NA</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>Hypoxia tracers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18F-FMISO (fluoromisonazol), 18F-FAZA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(fluoroazoxycyanuric acid) and 18F-FAZM (diacetyl-bis-methylthiosemicarbazone)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18F-FLT (Fluorothymidine)</td>
<td>2009</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>18F-GAPI (Fibroblast activation protein inhibitors)</td>
<td>2018</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18F-FES (Fluorostreiodiol)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>68Zr-trastuzumab</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iodine-124</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

Source: Sofia C Vaz, Francisco Oliveira et al. 2020
DOI: 10.1259/bjr.20200095
The \textbf{FDG} molecule is characterized by being a glucose analogue, coupled with radioisotope. As most cancer cells have a higher glycolytic activity, it can easily be inferred that the uptake of 18F-FDG will be higher in these cells; The image appears with higher uptake of the radiopharmaceutical in the tumor cells when compared to normal cells.
Complex emotion, felt in a potentially dangerous or unknown situation for the individual.

(Pifarré et al 2011)
1. Introduction

2. Anxiety

Physiological

- Muscle tension;
- Fatigue
- Tremors
- Frequent urination
- Variation in blood glucose levels

Psychological

- Decrease perception of self-efficacy;
- Disconfort;
- Irritability

Behavioural

- Movement of patient

It can take many forms, as:


2. Research questions

(a) How can anxiety be levels and measured in cancer patients undergoing PET, and which factors cause anxiety?

(b) Which non-pharmacological strategies can be used in reducing anxiety in patients undergoing PET?
3. Aims

1) to describe the cancer patients undergoing PET/CT scans with 18F-FDG anxiety levels and the measures that are used to assess these levels;

2) to identify the main factors contributing to anxiety;

3) to present non-pharmacological strategies to reduce patients anxiety.
4. Methodology

**Aims: 1 and 2**
Systematic Review (a)

- CINAHL, PsycINFO, PubMed, Scopus, Web of Science, and other manual search sources;
- Articles published from January 2000 to December 2020;
- "Patient anxiety"; AND "PET CT" AND "Oncology"

**Aim 3**
Systematic Review (b)

- PubMed; Science Direct
- Articles published from January 2000 to June 2020
- “PET/CT” AND “anxiety” AND “patient satisfaction” AND “relaxation techniques”
4. Methodology

Inclusion criteria

- Adult oncological patients
- PET/CT with $^{18}$F-FDG
- Anxiety measures
- Factors contributing to anxiety

Exclusion criteria

- Paediatric patients;
- PET/CT with other RF
- Articles exclude anxiety assessment
- Systematic reviews

Aim 1 and 2
Systematic Review (a)

- Adult patients
- PET/CT
- Non-pharmacological strategies to reduce Anxiety

Aim 3
Systematic Review (b)

Matthew et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372, 71
5. Results

Aim 1 and 2

Records identified through database search (n=100)
- Additional records identified through other sources (n=1)
- Records after duplicated removed (n=22)
  - Title/abstract screened (n=71)
    - Records excluded (n=17)
  - Full text articles assessed for eligibility (n=54)
    - Full text articles excluded with reasons (n=44)
      - Other population (n=35)
      - Not PET/CT exam (n=3)
      - Different outcome (n=6)
- Articles included for literature review (n=10)

Aim 3

Records identified through database search (n=385)
- Additional records identified through other sources (n=35)
- Records after duplicated removed (n=27)
  - Title/abstract screened (n=816)
    - Records excluded (n=794)
  - Full text articles assessed for eligibility (n=22)
    - Full text articles excluded with reasons (n=14)
      - Not available (n=14)
      - Literature review (n=2)
      - Not included non-pharmacological strategies (n=4)
      - Anxiety not assessed (n=4)
      - Other Nuclear Medicine exams (n=2)
      - Correlation psychological disturbance with PET/CT (n=1)
- Articles included for literature review (n=5)

Source: Vieira et al (2021)

Source: Pedro et al (2020)
Psychological parameters

- Aim 1 - Measures

Subjective measurements

SEQ – Scan Experience Questionnaire;
HADS - Hospital Anxiety Depression Scale
SRQ - Self-Report Questionnaire
STAI - Spielberger State-Trait Anxiety Inventory

5. Results

Aim 1 - Measures

Physiological parameters

Vogel et al., (2012), Netherlands; Santos et al. (2018), Portugal.

Objective measurements

Blood pressure /Heart Rate
Electrodermal activity
Electromyography

5. Results

Aim 1 - Measures

Biochemical parameters

Vogel et al., (2012), Netherlands;

Saliva cortisol

5. Results

Aim 1 - Levels

Pre-scan Anxiety levels

Most patients felt anxiety

<table>
<thead>
<tr>
<th>Percentage (%)</th>
<th>STAI average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pifarré et al., (2011), 67.5%</td>
<td><strong>Grilo at al., (2020), 44.7 ± 10,</strong> total of <strong>80 points</strong> (STAI-S)</td>
</tr>
<tr>
<td>Vogel et al., (2012), 59.0%</td>
<td>Elboga et al., (2015) <strong>40.4 ± 8.5</strong></td>
</tr>
<tr>
<td>Grilo et al., (2017), 82.7%</td>
<td>Abreu et al., (2016), <strong>6.4 ± 2.7</strong> on a 10-point</td>
</tr>
<tr>
<td>Santos et al., (2018), 6.5 ± 4.0, total of <strong>24 points</strong> (STAI-S brief version)</td>
<td>Lorca et al., (2019), 28.28 ± 8.08, total of <strong>60 points</strong> (STAI-S)</td>
</tr>
</tbody>
</table>
5. Results

Aim 2 - Factors

Preparation and procedure

Diagnostics

- Outcomes and consequent clinical decisions

Radiation

- Fear of pain or discomfort

Equipment

knowledge

E P D R

anxiety factors

5. Results

Aim 3 – Non-pharmacological Strategies

Audiovisual
(Yuyung et al., 2019; Vogel et al., 2012)

Listening to music
(Lee at al., 2016; Santos et al., 2018, Ponard, 2020)

Communication
(Acuff et al., 2014; Ponard, 2020; Westerman et al., 2004)

Mindfulness
(Lorca et al., 2019)

Strategies to reduce anxiety
5. Results

Aim 3: Non-pharmacological strategies to reduce anxiety

Listening to music applied at different examination times

- Watermark by Enya – 71 bpm
  - https://www.youtube.com/watch?v=bPCds a7hS7M

- Symphony No. 5 – 79 bpm
  - https://www.youtube.com/watch?v=jv2WJMVP Qi8

songs without lyrics

slow music with 60 to 80 beats per minute

5. Results

Aim 3

Audiovisual

- Non-pharmacological strategies to reduce anxiety

- behaviour strategies
  - Examples of videos from:
    - Nature
    - Sea

- educational strategies
  - What is it Like to Have a PET Scan? | Cancer Research UK

www.youtube.com/watch?v=_2c8YZwzaMk

https://www.youtube.com/watch?v=Te923WMki_k
5. Results

Aim 3: Non-pharmacological strategies to reduce anxiety

Mindfulness

It promotes self-awareness, total attention, breath contact and acceptance of positive or negative thoughts and reflections

Lorca et al (2019)
5. Results

Aim 3

Non-pharmacological strategies to reduce anxiety

Face-to-face communication Health professional-patient

Invest in the beginning:
• Create rapport quickly;
• Raise the patient's concerns

Providing information:
• Procedure
• Sensory
• Radiation Risk
Knowing the factors that cause anxiety

Non-pharmacological strategies

Health professionals can reduce anxiety

Increase patient satisfaction

Improve quality of Image

6. Conclusion