Plataforma de Oncología

Papel de la Medicina Nuclear en la mama diseminada
INTRODUCCIÓN

El servicio de Medicina Nuclear de la Fundación TEDECA cuenta con una planta particularmente avanzada e innovadora, con un personal altamente capacitado y numerosos equipos de última generación. El objetivo de esta unidad es ofrecer un servicio integral, multidisciplinario y de alta calidad en el campo de la Medicina Nuclear y las técnicas de imagen diagnósticas.

Material y Tecnología aplicadas en planteles sanitarios de la Fundación TEDECA

- Cuatro habitaciones especialmente diseñadas para el estudio de enfermedades neuropsiquiátricas y hematológicas.
- Tomodensitometría de alta resolución, que permite el estudio de los órganos de la médula ósea, y a continuación, el estudio de la densidad ósea.
- Detección de melanomas.
- Núcleo de medicina nuclear con equipos de última generación: SIGHT, GATED, LATTE, etc.

GAMMA OSEA

- Tomografía por emisión de positrones (PET-CT)
- Monitorización de la actividad de las células T y B
- Gammaproteínas y imán nuclear óseo
- SPECT y SPECT óseo
- RCE Gallo-67
- RCE Yodo-131
- RCE Yodo-123
- RCE Yodo-MBG
- RCE indóxido acetato
- RCE inmunoglobulina anti-CEA

NEUROLÓGICAS

- Citometría isótopica
- SPECT cerebral perfusión
- SPECT cerebral viabilidad tumoral

NEFROLÓGICAS

- Gammaferografía renal dinámica
- Flujo plasmático renal
- Gammaferografía renal postoperatoria
- Gammaferografía renal ONSA

ONCOLOGÍCAS

Diagnósticas

- Tomografía por emisión de positrones (PET-CT)
- Monitorización de la actividad de las células T y B
- Gammaproteínas y imán nuclear óseo
- SPECT y SPECT óseo
- RCE Gallo-67
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- RCE Yodo-MBG
- RCE indóxido acetato
- RCE inmunoglobulina anti-CEA

Terapéuticas

- Tratamientos de cáncer de tiroides
- Tratamientos con Estroncio-90
- Tratamientos con Samario-153
- Tratamientos con Yodo-131

ENDOCRINOLÓGICAS

- Gammaferografía tiroides
- Gammaferografía paratiroides
- Gammaferografía suprarrenales
- Tratamientos hipertiroidismo con Yodo

DIGESTIVAS

- Gammaferografía glándulas salivales
- Gammaferografía reflúo gastro-espásico
- Vaciamiento gástrico
- Gammaferografía hepática
- Gammaferografía esplénica
- Gammaferografía hepatobiliar
- SPECT heptomasas
- Gammaferografía de mucosa gástrica endoscópica (D. Meckel)

OTRAS

- Detección de sangrado con hemorrafía marcados
- Gammaferografía perfusión pulmonar
- Linografía endoscópica
- Angiografía isótopica
- Densitometría ósea
Cardiotoxicity of nonanthracycline cancer chemotherapy agents:

- Arrhythmias (e.g., histone deacetylase inhibitors, nilotinib)
- Myocardial necrosis causing a dilated cardiomyopathy and clinical heart failure (e.g., sunitinib, alemtuzumab, imatinib)
- Vasospasm or vasoocclusion resulting in angina or myocardial infarction (e.g., 5-fluorouracil, particularly infusional administration, etoposide)
- Pericarditis (e.g., cytarabine, bleomycin)

Advantages — The equilibrium RVG has several advantages for LVEF measurement:

- High accuracy and reproducibility
- Measurements do not rely on geometric assumptions regarding the shape of the LV
- Global and regional LV systolic function can be assessed
- Functional information for all cardiac chambers (both atria and ventricles) is readily available
- Phase analysis of segmental ventricular contraction conveys information for regional dyssynergy
- The technique can be used for accurate volumetric measurements with the use of an appropriate phantom and corrections for soft tissue attenuation
- The patient's body habitus does not limit the technique and virtually all patients can be imaged
- The noninvasive nature of the test minimizes associated risks
- RVG is easy to perform and not time consuming (less than 30 minutes)

Ref. UpToDate, last updated: noviembre 24, 2009
Plataforma de Oncología

Hospital San Jaime
Torrevieja - Alicante

Post
Ant
Gammagrafía Osea
### Updated clinical practice guidelines for the care and treatment of breast cancer: Follow-up after treatment for breast cancer

<table>
<thead>
<tr>
<th>Cognitive functioning</th>
<th>Fatigue</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients with breast cancer should have regular follow-up surveillance.</td>
<td>Fatigue may affect approximately one-quarter to one-third of breast cancer survivors. Patients should be asked about symptoms of fatigue.</td>
</tr>
<tr>
<td>The frequency of visits should be adjusted according to individual patient’s needs.</td>
<td>Physiologic causes of fatigue should be investigated and ruled out. Depression and pain are potentially treatable underlying factors.</td>
</tr>
<tr>
<td>All visits should include a medical history. For women who are taking tamoxifen, it is important to ask about vaginal bleeding. Physical examination should include breasts, regional lymph nodes, chest wall, lungs and abdomen. The arms should be examined for lymphedema. Annual visits should include mammographic examination.</td>
<td>Prospective longitudinal controlled studies should be encouraged.</td>
</tr>
<tr>
<td>Routine laboratory and radiographic investigations should not be carried out for the purpose of detecting distant metastases.</td>
<td><strong>Weight management</strong></td>
</tr>
<tr>
<td>Patients should be encouraged to report new, persistent symptoms promptly, without waiting for the next scheduled appointment.</td>
<td>Weight management should be discussed with all breast cancer survivors.</td>
</tr>
<tr>
<td>If a woman wishes to carry out breast self-examination, it is reasonable to teach her the proper procedure.</td>
<td>Overweight patients should be encouraged to participate in evidence-based weight-management programs.</td>
</tr>
<tr>
<td>Psychosocial support should be encouraged and facilitated.</td>
<td><strong>Osteoporosis</strong></td>
</tr>
<tr>
<td>Participation in clinical trials should be encouraged and facilitated.</td>
<td>Patients who are post menopausal, or are premenopausal with risk factors for osteoporosis, or are taking aromatase inhibitors should undergo a screening bone mineral density test.</td>
</tr>
<tr>
<td>The responsibility for follow-up should be formally allocated to a single physician.</td>
<td>Patients should be counseled on exercise and on adequate intake of calcium and vitamin D.</td>
</tr>
<tr>
<td>Communication between all members of the team must be ensured to avoid duplication of visits and tests.</td>
<td>Osteoporosis treatment should include a bisphosphonate.</td>
</tr>
</tbody>
</table>

### Cognitive functioning

<table>
<thead>
<tr>
<th>Cognitive functioning</th>
<th>Fatigue</th>
</tr>
</thead>
<tbody>
<tr>
<td>There may be an effect of chemotherapy on cognitive functioning, which may be sustained. However, there is no correlation between subjective complaints of cognitive impairment and objective measures.</td>
<td>Fatigue may affect approximately one-quarter to one-third of breast cancer survivors. Patients should be asked about symptoms of fatigue.</td>
</tr>
<tr>
<td>Prospective longitudinal controlled studies should be encouraged.</td>
<td>Physiologic causes of fatigue should be investigated and ruled out. Depression and pain are potentially treatable underlying factors.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Región</th>
<th>DMC (g/cm²)</th>
<th>AJ T-Score</th>
<th>AE Z-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2</td>
<td>0.345</td>
<td>-2.1</td>
<td>-1.0</td>
</tr>
<tr>
<td>L3</td>
<td>0.307</td>
<td>-2.4</td>
<td>-1.3</td>
</tr>
<tr>
<td>L4</td>
<td>0.256</td>
<td>-3.1</td>
<td>-2.0</td>
</tr>
<tr>
<td>L2-L3</td>
<td>0.358</td>
<td>-2.9</td>
<td>-1.1</td>
</tr>
<tr>
<td>L2-L4</td>
<td>0.358</td>
<td>-2.9</td>
<td>-1.1</td>
</tr>
<tr>
<td>L3-L4</td>
<td>0.362</td>
<td>-2.8</td>
<td>-1.7</td>
</tr>
</tbody>
</table>

*Esta imagen no es para diagnóstico.*
I. PET-CT

II. Terapia metabólica
1. PET-CT

**Diagnóstico Mx:**
PET FREnte ESTUDIOS DE IMAGEN CONVENCIONAL

**Respuesta al tratamiento:**
CUAL ES LA LIMITACIÓN DEL PET FDG?

**PET-CT no FDG**
Informe AETS Noviembre 2005 la PET es esencial en el manejo clínico del paciente oncológico 92% de los pacientes, detectando nuevas lesiones en el 39%, modificando diagnóstico o estadio en un 57%, cambiando el tratamiento propuesto en un 79% (53% con cambio de modalidad), evitando pruebas invasivas o de riesgo en un 76%, terapias innecesarias en un 76% y de utilidad a juicio del clínico solicitante en el 88%.
• Mtx al diagnóstico 1-5% ptes
• Riesgo de recurrencia del cáncer de mama
  – 7-30% y Mtx 45-90% (Bongers et al, 2004)
• Latencia
  – 814 ptes N+
  – 18% recurrencias en los 10 primeros años
  – Recurrencias hasta 23.5 años

## Summary of 2006 ASCO guideline recommendations for surveillance after breast cancer treatment

<table>
<thead>
<tr>
<th>Mode of surveillance</th>
<th>Summary of recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommended breast cancer surveillance</strong></td>
<td></td>
</tr>
<tr>
<td>History/physical examination</td>
<td>Every 3 to 6 months for the first three years after primary therapy; every 6 to 12 months for years 4 and 5; then annually</td>
</tr>
<tr>
<td>Patient education regarding symptoms of recurrence</td>
<td>Physicians should counsel patients about the symptoms of recurrence including new lumps, bone pain, chest pain, abdominal pain, dyspnea or persistent headaches; helpful websites for patient education include <a href="http://www.cancer.net/patients">www.cancer.net/patients</a> and <a href="http://www.cancer.net/portal/site/patient">www.cancer.net/portal/site/patient</a></td>
</tr>
<tr>
<td>Referral for genetic counseling/testing</td>
<td>Criteria include: Ashkenazi Jewish heritage, history of ovarian cancer at any age in the patient or any first- or second-degree relatives; any first-degree relative with a history of breast cancer diagnosed before the age of 50 years; two or more first- or second-degree relatives diagnosed with breast cancer at any age; patient or relative with diagnosis of bilateral breast cancer; or history of breast cancer in a male relative</td>
</tr>
<tr>
<td>Breast self-examination</td>
<td>All women should be counseled to perform monthly breast self-examination</td>
</tr>
<tr>
<td>Mammography</td>
<td>First post-treatment mammogram 1 year after the initial mammogram that leads to diagnosis but no earlier than 6 months after definitive radiation therapy; subsequent mammograms should be obtained as indicated for surveillance of abnormalities</td>
</tr>
<tr>
<td>Coordination of care</td>
<td>Continuity of care for breast cancer patients is encouraged and should be performed by a physician experienced in the surveillance of cancer patients and in breast examination, including the examination of irradiated breasts; if follow-up is transferred to a PCP, the PCP and the patient should be informed of the long-term options regarding adjuvant hormonal therapy for the particular patient; this may necessitate referral for oncology assessment at an institution with guidelines for adjuvant hormonal therapy</td>
</tr>
<tr>
<td>Pelvic examination</td>
<td>Regular gynecologic follow-up is recommended for all women; patients who receive tamoxifen should be advised to report any vaginal bleeding to their physicians</td>
</tr>
<tr>
<td>Routine blood tests</td>
<td>CBCs and liver function tests are not recommended</td>
</tr>
<tr>
<td>Imaging studies</td>
<td>Chest x-ray, bone scans, liver ultrasound, computed tomography scans, FDG-PET scans, and breast MRI are not recommended</td>
</tr>
<tr>
<td>Tumor markers</td>
<td>CA 15-3, CA 27.29, and carcinoembryonic antigen are not recommended</td>
</tr>
<tr>
<td>FDG-PET</td>
<td>FDG-PET scanning is not recommended for routine breast cancer surveillance</td>
</tr>
<tr>
<td>Breast MRI</td>
<td>Breast MRI is not recommended for routine breast cancer surveillance</td>
</tr>
</tbody>
</table>
FDG-PET is a useful tool in staging advanced breast cancer and assessing the extent of disease involvement when metastasis is suspected. It might also aid in assessing early response to therapy.

Visceral disease

- FDG-PET sensitivity of 86%-87% and a specificity of 86%-83%, compared with 36%-43% and 95%-98% for conventional imaging (50-119 ptes)

- Staging of advanced breast cancer; retrospective study of 125 patients change of the clinical stage in 67% (43% upstaged and 24% downstaged). In 32%, this resulted in a change in treatment plan

- 175 ptes with locorregional recurrence PET detected distant metastasis in 16% of patients; 24% had evidence of distant metastasis within 18 months

- Limited role in detecting brain metastases

Table 3

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Comments/Author Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pecking et al.,[70] 2001</td>
<td>119</td>
<td>93%</td>
<td>30%</td>
<td>PET is valuable in detecting occult metastasis in asymptomatic patients with elevated tumor marker CA 15-3</td>
</tr>
<tr>
<td>Grahak et al.,[71] 2004</td>
<td>75</td>
<td>94%</td>
<td>78%</td>
<td>A questionnaire was sent to the referring clinician to evaluate the impact of PET on management; change in management was 44%</td>
</tr>
<tr>
<td>Gallowitsch et al.,[72] 2003</td>
<td>62</td>
<td>97%</td>
<td>82%</td>
<td>In clinically suspicious cases with negative tumor marker, PET was reliable in detecting metastasis</td>
</tr>
<tr>
<td>Eubank et al.,[76] 2004</td>
<td>61</td>
<td>94%</td>
<td>91%</td>
<td>PET altered the therapeutic plan in 32% of patients</td>
</tr>
<tr>
<td>Fueger et al.,[73] 2005</td>
<td>58</td>
<td>64%</td>
<td>84%</td>
<td>Compared PET/CT with PET alone and found equivalent results</td>
</tr>
<tr>
<td>Kamel et al.,[68] 2003</td>
<td>57</td>
<td>100%</td>
<td>97%</td>
<td>FDG-PET was more sensitive than the serum tumor marker CA 15-3 in detecting relapsed breast cancer</td>
</tr>
<tr>
<td>Moon</td>
<td>57</td>
<td>93%</td>
<td>79%</td>
<td>Bone metastases had a significantly</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Reference</th>
<th>Lesions</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohta et al. [30] 2001</td>
<td>51</td>
<td>78%</td>
<td>98%</td>
</tr>
<tr>
<td>Racen et al. [75] 2006</td>
<td>46</td>
<td>90%</td>
<td>71%</td>
</tr>
<tr>
<td>Lonneux et al. [53] 2006</td>
<td>39</td>
<td>94%</td>
<td>50%</td>
</tr>
<tr>
<td>Suarez et al. [76] 2002</td>
<td>38</td>
<td>92%</td>
<td>75%</td>
</tr>
<tr>
<td>Eubank et al. [28] 2001</td>
<td>33</td>
<td>85%</td>
<td>90%</td>
</tr>
<tr>
<td>Weir et al. [77] 2005</td>
<td>27</td>
<td>89%</td>
<td>88%</td>
</tr>
<tr>
<td>Landheer et al. [40] 2005</td>
<td>25</td>
<td>95%</td>
<td>20%</td>
</tr>
</tbody>
</table>

- Larger proportion of false-negative lesions than other nonosseous malignant sites
- Compared detection of bone metastasis with bone scan
- Looked at patients with rising tumor marker; PET affected 51% of patient management
- 34 patients were included because of asymptomatic tumor marker increase
- Asymptomatic patients with progressive elevation of tumor markers CEA and CA 15.3
- Evaluated suspected disease in the mediastinum and internal mammary nodes
- Discordant metastases were demonstrated in 30% of patients who were thought only to have locoregional recurrence
- In primary breast cancer setting, patient management was changed for 5 women

CEA = carcinoembryonic antigen; CT = computed tomography; FDG = [18F]fluorodeoxyglucose; PET = positron-emission tomography.

High therapeutic impact.
Bone Disease

- 51 patients with bone metastasis. PET had a similar sensitivity to bone scintigraphy (78%), but had a better specificity (98% vs 81%).

- FDG-PET advantage:
  - visualizing the metabolic activity of tumor cells rather than detecting the osteoblastic response to destruction
  - Bone scans are positive when there is an osteoblastic response, and thus, they might remain positive even after successful treatment (2-12 months)
  - Equipment: spatial resolution PET-CT

- FDG-PET scan appears to have a lower rate of sensitivity compared to bone scan in detecting osteoblastic lesions

FDG-PET scan is to complement the information obtained from a bone scan rather than replace it

42 studies FDG-PET vs CI (US, CT, MRI, SMM) Pathology +/- 6 months follow up
US and MRI highest pooled specificity (96-93%)
MRI and PET highest pooled sensitivity (95%)

Table 9 Summary estimates of sensitivity, specificity, and diagnostic odds ratio (DOR) for US, CT, MRI, SPECT and PET

<table>
<thead>
<tr>
<th>Modality</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Diagnostic OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>0.8570 (0.8040–0.8990)</td>
<td>0.9620 (0.9540–0.9700)</td>
<td>40.9280 (18.2940–91.5670)</td>
</tr>
<tr>
<td>CT</td>
<td>0.8480 (0.8110–0.8810)</td>
<td>0.7530 (0.6920–0.8070)</td>
<td>13.6200 (4.8870–37.9540)</td>
</tr>
<tr>
<td>MRI</td>
<td>0.9500 (0.9230–0.9700)</td>
<td>0.9290 (0.9020–0.9500)</td>
<td>131.7800 (70.9310–244.8100)</td>
</tr>
<tr>
<td>SMM</td>
<td>0.9000 (0.8530–0.9370)</td>
<td>0.7980 (0.7150–0.8660)</td>
<td>29.4190 (14.8800–58.1640)</td>
</tr>
<tr>
<td>PET</td>
<td>0.9530 (0.9370–0.9650)</td>
<td>0.8630 (0.8240–0.8950)</td>
<td>106.8800 (68.1040–167.7300)</td>
</tr>
</tbody>
</table>
After neoadjuvant chemotherapy

- A prospective study utilized serial FDG-PET/CT to predict pathologic response after neoadjuvant chemotherapy in patients with stage II or III breast cancer; sensitivity of 89% with a specificity of 95% after two cycles.
- 30 patients with large (> 3 cm) primary breast tumors or advanced breast cancer. FDG-PET had a sensitivity of 90% in predicting complete pathologic response after the first cycle of chemotherapy.
- Burcombe et al evaluated complete pathologic response in 10 patients who had a good clinical response after receiving neoadjuvant chemotherapy. While no patients had abnormal uptake on FDG-PET prior to surgery, nine of them were found to have residual invasive carcinoma ranging from 2 to 20 mm in size.

Serial PET scans had a higher sensitivity in assessing response to treatment, compared with studies using a single PET scan.

Systemic and Hormonal Therapy

- Mortimer et al noted a greater degree of ER blockade in patients who had a decrease in SUV value on their FDG-PET scan.

- 20 patients with hormone-refractory or hormone receptor-negative metastatic breast cancer. Semiquantitative analysis of FDG-PET metabolic response predicted short-term and overall survival when assessed after three cycles of chemotherapy.
18F-FDG PET correctly predicted the responses after the first cycle of chemotherapy and was more accurate than CI after the third cycle of chemotherapy.
Early Prediction of Response to Chemotherapy in Metastatic Breast Cancer Using Sequential $^{18}$F-FDG PET

Joerg Dose Schwarz, MD; Michael Bader, MD; Lars Jenicke, MD; Gabriele Hemminger, MD; Fritz Jänicke, MD; and Norbert Avril, MD

1Department of Gynecology, University Hospital Hamburg-Eppendorf, Hamburg, Germany; 2Department of Nuclear Medicine, University Hospital Hamburg-Eppendorf, Hamburg, Germany; and 3Division of Nuclear Medicine, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania

• SUV decreased to 72% ± 21% after the first cycle and 54% ± 16% after the second

• Not responding to 94% ± 19% after the first cycle and 79% ± 9% after the second cycle (differences statistically significant)

• Visual analysis predicted the response in all patients as early as after the first cycle of chemotherapy

![Graph showing changes in SUV in responding and nonresponding metastases.](image)
• Statistically significant correlation between PET scan, circulating tumor cells, and CA 27.29

• CA 27.29 had a high PPV of 90%, low sensitivity of 59% in detecting metastatic disease shown on PET scan.

• Detection of more than 5 cells per 7.5 mL of blood had a positive predictive value of 100% with 100% specificity of having an abnormal PET scan

A retrospective analysis of 115 MBC patients who started a new line of therapy and who had CTC counts and FDG-PET/CT scans performed at baseline and at 9 to 12 weeks during therapy (midtherapy).

Detection of five or more CTCs during therapeutic monitoring can accurately predict prognosis in MBC beyond metabolic response.

(Midtherapy CTC levels correlated with FDG-PET/CT response in 67%; midtherapy CTC counts and FDG-PET/CT response predicted overall survival (P < .001 and P <.001, respectively). FDG-PET/CT predicted overall survival (P < .0086) in 31 (91%) of 34 discordant patients who had fewer than five CTCs at midtherapy).

FDG-PET/CT deserves a role in patients who have fewer than five CTCs at midtherapy.
Biological characterisation of breast cancer by means of PET

Andreas K. Buck, Holger Schirmeister, Torsten Mattfeldt, Sven N. Reske

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2 Department of Pathology, University Hospital Ulm, Germany

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Fig. 1. a, b FDG PET of a patient with invasive ductal breast cancer: transaxial and sagittal sections. Arrows indicate high FDG uptake within the lesion (mean TBR 2.4). c Ki-67 immunohistochemistry demonstrates low proliferative activity (specific antikeratin, diamino-benzidine, brown signal, approx. 2% immunoreactive cells) and a low fraction of tumour cells. d, e FDG PET of a patient with invasive ductal breast cancer: transaxial and sagittal sections. Arrow indicates intense lesion FDG uptake (mean TBR 2.27). f Ki-67 immunohistochemistry demonstrates high proliferative activity (approx. 45% immunoreactive cells) and a high fraction of tumour cells.
• 18-F-FES
• 18F-FLT
• 15O-water
• 18F-Fluoride
- 18F-FES uptake in breast cancer reflects estrogen receptor status.
- SUV of $\geq 2.0$ is considered positive for estrogen receptor expression.


• (11)C]methyl-2-{4-[bis(4-hydroxyphenyl)methylene]cyclohexyl}acetate([11C]16a)
• [(11)C]methyl-4- [bis(4hydroxyphenyl)methylene]cyclohexanecarboxylate([11C]16b)
• [(11)C]methyl-2-{3-[bis(4-hydroxyphenyl)methylene]cyclohexyl}acetate([11C]18a)
• [(11)C]methyl-3-[bis(4-hydroxyphenyl)methylene]cyclohexanecarboxylate([11C]18b)
18F-FLT PET for treatment monitoring in metastatic breast cancer detected changes in breast cancer proliferation 1 wk-2 wks after the initiation of combination chemotherapy.


Biological characterisation of breast cancer by means of PET

Andreas K. Buck¹, Holger Schirmeister¹, Torsten Mattfeld², Sven N. Reske¹

¹ Department of Nuclear Medicine, University Hospital Ulm, Ulm, Germany
² Department of Pathology, University Hospital Ulm, Germany

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Fig. 4. a, b FDG PET of a patient with multiple osteoclastic bone metastases from breast cancer. While the liver metastasis is easy to detect, there is only low or absent FDG uptake in the osteoclastic bone metastases. c, d Bone metastases in the pelvis and thoracic vertebral column are only visible on ¹⁸F-fluoride PET.
II. Terapia metabólica

• El cáncer óseo metastásico es una complicación severa y común en la enfermedad avanzada:
  
  ✓ Hasta un 70% de los pacientes con c. próstata y mama
  
  ✓ Hasta 30% en c. pulmón, vejiga y tiroides

• El manejo de estos pacientes debe ser multidisciplinar e incluye:
  
  ✓ Analgesia, Bifosfonatos
  
  ✓ Radioterapia, Cirugía
  
  ✓ Quimioterapia, Hormonoterapia
  
  ✓ Radioisótopos
### TABLE 2 Administered Activities, Typical Response Times and Duration, and Retreatment Intervals for Bone-Seeking Radionuclides

<table>
<thead>
<tr>
<th>Radiopharmaceutical</th>
<th>Usual administered activity</th>
<th>Typical response time</th>
<th>Typical response duration</th>
<th>Retreatment interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{32}$P</td>
<td>444 MBq [fractionated]</td>
<td>14 d</td>
<td>10 wk</td>
<td>&gt;3 mo</td>
</tr>
<tr>
<td>$^{89}$SrCl$_2$</td>
<td>148 MBq</td>
<td>14–28 d</td>
<td>12–26 wk</td>
<td>&gt;3 mo</td>
</tr>
<tr>
<td>$^{186}$Re-HEDP</td>
<td>1.3 GBq</td>
<td>2–7 d</td>
<td>8–10 wk</td>
<td>&gt;2 mo</td>
</tr>
<tr>
<td>$^{188}$Re-HEDP</td>
<td>1.3–4.4 GBq</td>
<td>2–7 d</td>
<td>8 wk</td>
<td>NE</td>
</tr>
<tr>
<td>$^{153}$Sm-EDTMP</td>
<td>37 MBq/kg</td>
<td>2–7 d</td>
<td>8 wk</td>
<td>&gt;2 mo</td>
</tr>
<tr>
<td>$^{117m}$Sn-DTPA</td>
<td>2–10 MBq/kg</td>
<td>5–19 d</td>
<td>12–16 wk</td>
<td>&gt;2 mo</td>
</tr>
<tr>
<td>$^{223}$RaCl$_2$</td>
<td>50–200 kBq/kg</td>
<td>&lt;10 d</td>
<td>NE</td>
<td>NE</td>
</tr>
</tbody>
</table>

NE = not established.
Gammagrafía ósea poco antes del tratamiento (FUNDAMENTAL)

- Hemograma / reserva hematopoyética
  - La mielotoxicidad reversible es el efecto adverso más frecuente en esta terapia
  - Una infiltración difusa de M.O. (patrón “superscan” en gammagrafía ósea)
  - Es importante el timing entre este y otros tratamientos mielosupresores

- Bioquímica (función renal y hepática adecuadas):
  - Una pobre función renal retrasará el aclaramiento del radiofármaco, aumentando la dosis corporal total y potencialmente su toxicidad
**TABLE 3** Criteria for Patient Selection for Bone-Seeking Radionuclide Therapy

<table>
<thead>
<tr>
<th>Treatment indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment refractory to bone pain despite analgesics</td>
</tr>
<tr>
<td>Positive bone scan; abnormal uptake corresponding to pain sites</td>
</tr>
<tr>
<td>Hematology: Hb &gt; 90 g/L; white cell count &gt; 4 x 10⁹/L; platelets &gt; 100 x 10⁹/L</td>
</tr>
<tr>
<td>Renal function: urea &lt; 12 mmol/L; creatinine &lt; 200 mmol/L</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancy</td>
</tr>
<tr>
<td>Acute spinal cord compression</td>
</tr>
<tr>
<td>Acute or chronic renal failure; glomerular filtration rate &lt; 30 mL/min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary incontinence; catheterize before treatment</td>
</tr>
<tr>
<td>Vesicoureteric or bladder outflow obstruction; consider ureteric stent or catheterize before treatment</td>
</tr>
</tbody>
</table>
Eficacia:

• Existen más estudios que incluyeron otros tumores (mama, pulmón, …)

• Alivio del dolor: 75% (30-85)

• Disminución en el uso de analgésicos: en 3-4 semanas

• Inicio de respuesta: 5-10 días / duración: hasta 4 meses

• Efectivo en dosis repetidas (se ha publicado que pueden mejorar la duración de la respuesta al dolor y la supervivencia)


• Se han publicado descensos en marcadores tumorales (PSA y FAIc) e intensidad en la gammagrafía ósea


  (Sartor O et al. Urology 2004; 63: 940-945)
Eficacia (II):

• Con dosis única datos de prolongación de supervivencia contradictorios:

    - 76 próstata, 36 mama, 2 pulmones y 9 “grupo mixto”
    - 18.5 MBq / kg vs. 37 MBq / kg
    - aumento de supervivencia para la dosis > en mama (no en próstata)

  ✓ Sartor O et al. Urology 2004; 63: 940-945
    - 152 próstata hormonorrefractario
    - 37 MBq / kg 153Sm-EDTMP vs. placebo
    - no diferencias en supervivencia global
• 28 tratamientos 153Sm-EDTMP (3 mama, 1 neuroendocrino, 1 esófago)

1- Mtx múltiples esqueleto axial y periféricas n=7 (Qt+zometa; RP) Tiempo a progresión 9 meses (bq y ósea). (OS=3.5 a.)

2- Mtx múltiples esqueleto axial y periféricas n=6 (Qt+H. RP) Tiempo a progresión >6meses (lost follow-up). (OS=5 a.)

3- Mtx esqueleto axial n=4, 5 meses (SD lost follow-up).
II. Terapia metabólica. Aspectos por resolver

• RIT vs RT externa
• RIT adyuvante a RT externa
• RIT en combinación con QT
• RIT en consolidación
• Nuevos fármacos: EMI SORES DE “CORTO ALCANCE”
  117mSn-DTPA
  223Ra (Alpharadin)
www.plataformadeoncologia.com
www.fundaciontedeca.org