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Comisión Nacional de Energía Atómica



Switching from labelled antibiotics to FDG-F18 PET/CT in Argentina

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Comisión Nacional de Energía Atómica

Labelled antibiotics

- 1991-1992 we started using in Argentina, Infecton* (ciprofloxacin *) sent to us by Prof. K.Britton & K.Solanki from St. Bartholomew's Hospital.
- Since 1992, through an IAEA CRP with Keith Britton, we worked with this radiolabelled antibiotic.



Comisión Nacional de Energía Atómica

Now, it's commercialized by two local Laboratories in a one step kit, with 4 mg ciprofloxacin to be used for two patients

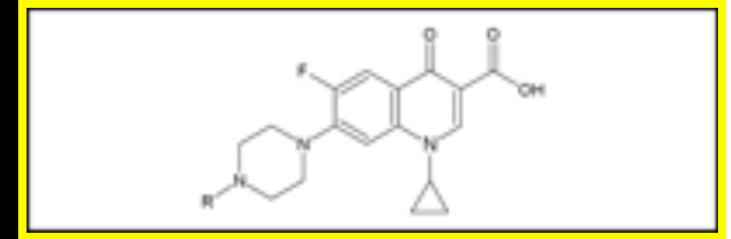


Why * labelled antibiotics?

Imaging infection/inflammation is independent of anatomical changes.

- LL, although considered 'gold standard' is laborious, requires blood handling & biological safety cabinets.
- Using clinical knowledge of the infection/inflammation process & pursuing simplicity new radioagents emerged: *liposomes*, **quinolones*, *chemotactic peptides*, *whole antibodies or fragments*, *cytokines*, *FDG-F-18*.

* labelled antibiotics



- Ciprofloxacin-99mTc scan

AIM:

SPECIFIC scan able to target living bacteria, present in the site of infection.

This broad spectrum antibiotic is a 4-fluoro-quinolone that detects acute & chronic infection either Gram (+) or (-)



Infecton

The ciprofloxacin- ^{99m}Tc is taken up, or metabolised by living bacteria.

Theoretically it should not accumulate in the inflammed focii

Excellent for identification of bone, joint & soft tissue infection.

Has performed better than **LL*** for vertebral osteomyelitis



Infecton scan

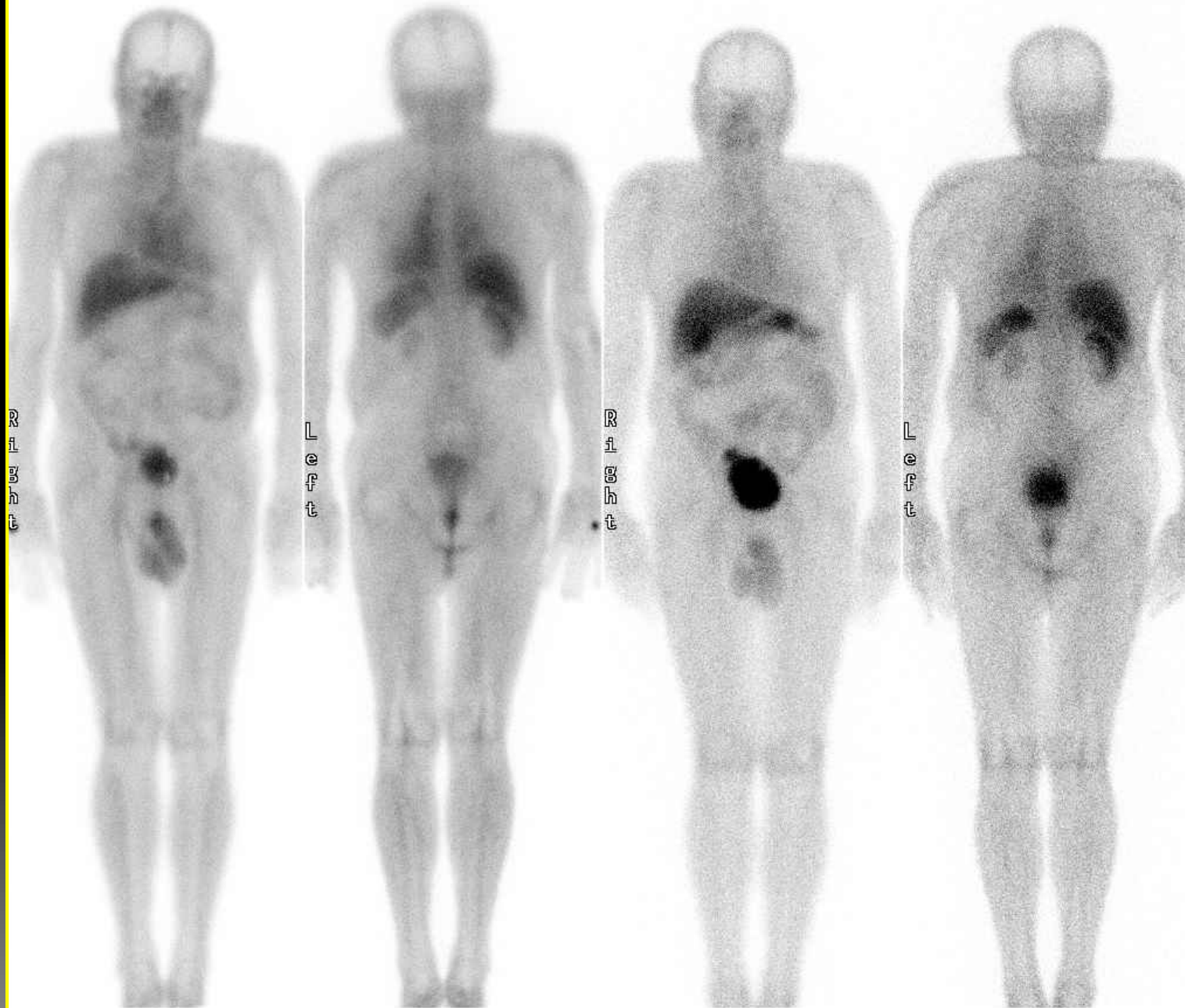
Does not accumulate in bone marrow.
No need to compare the images with a sulfur colloid scan, as requires in bone infections with LL*

Ant

Post

Ant

Post



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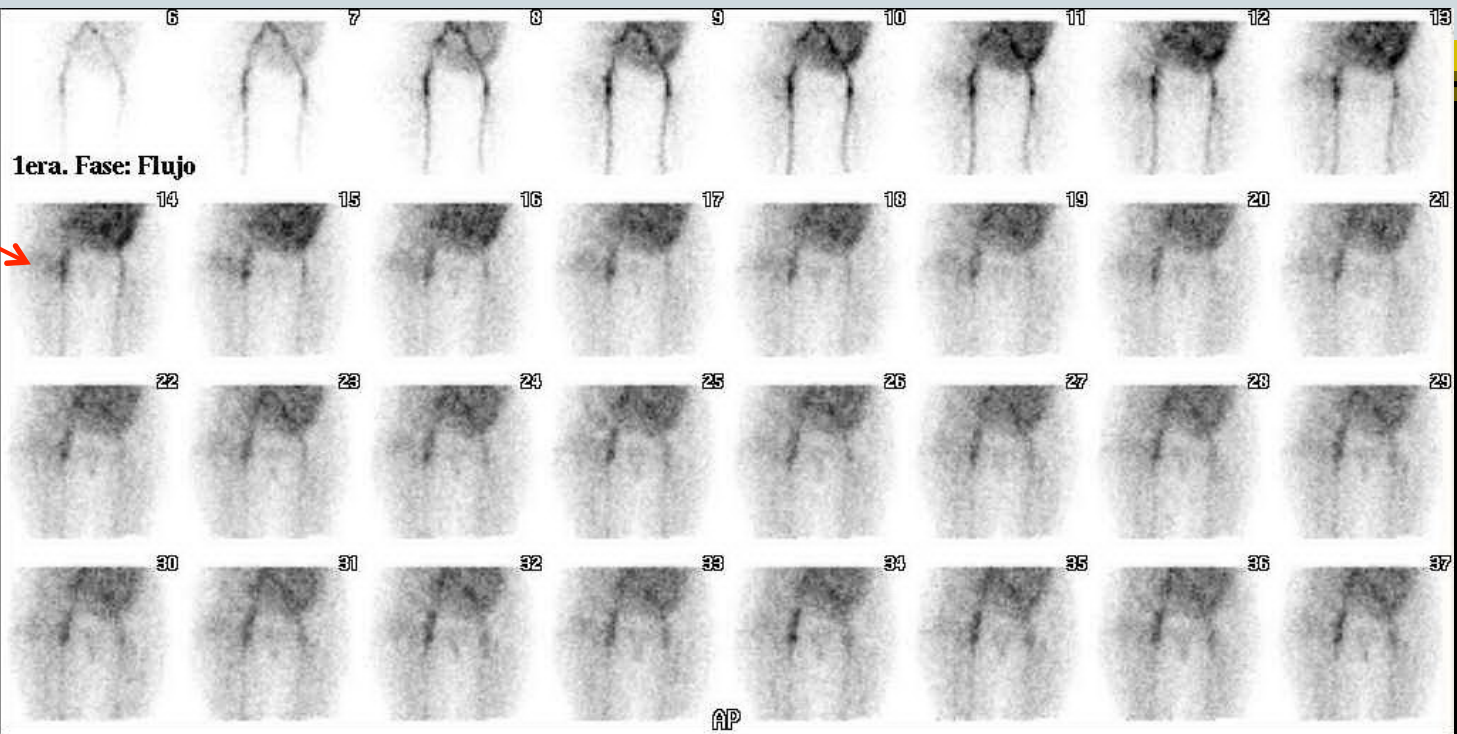
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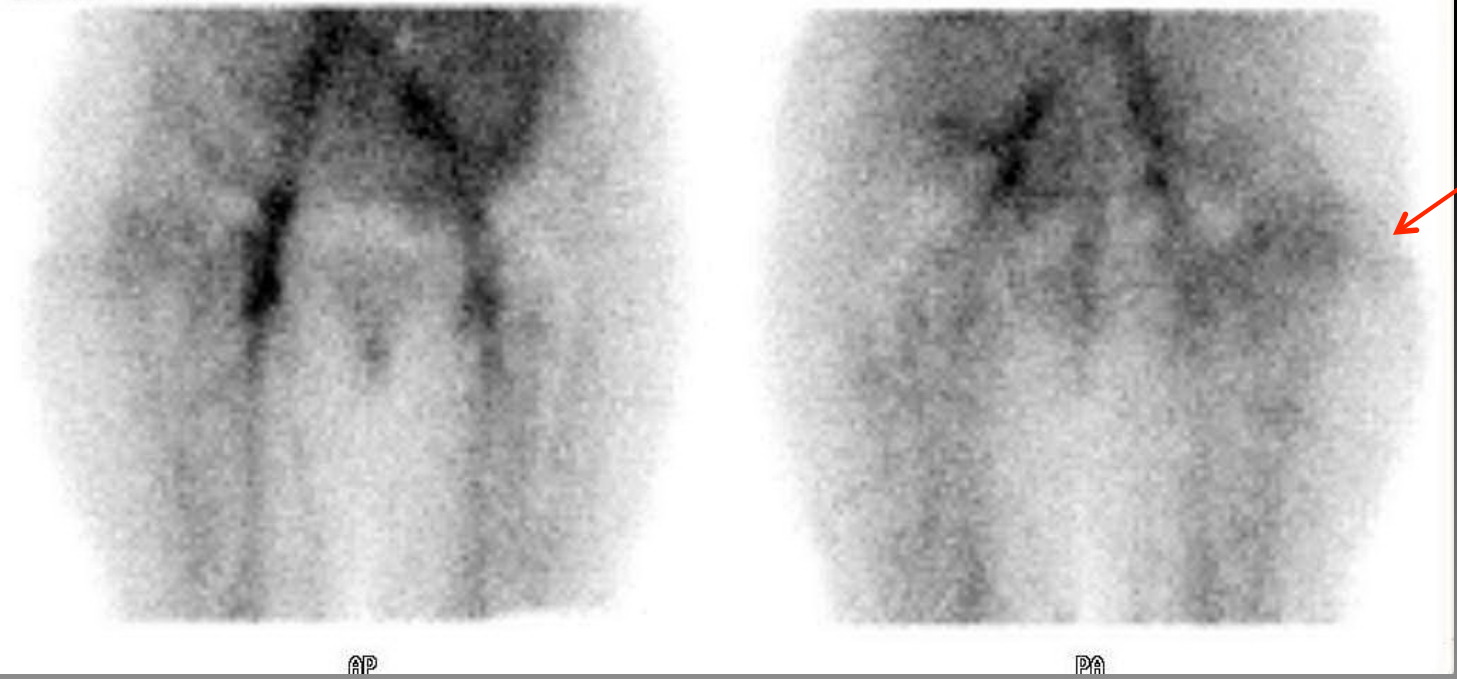
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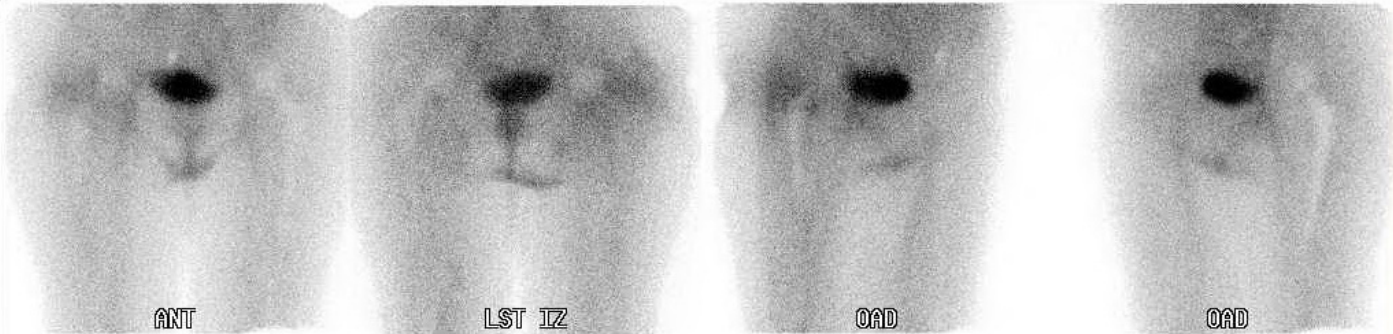
IMAGENES DE 4 HORAS

IMAGENES DE 24 HORAS

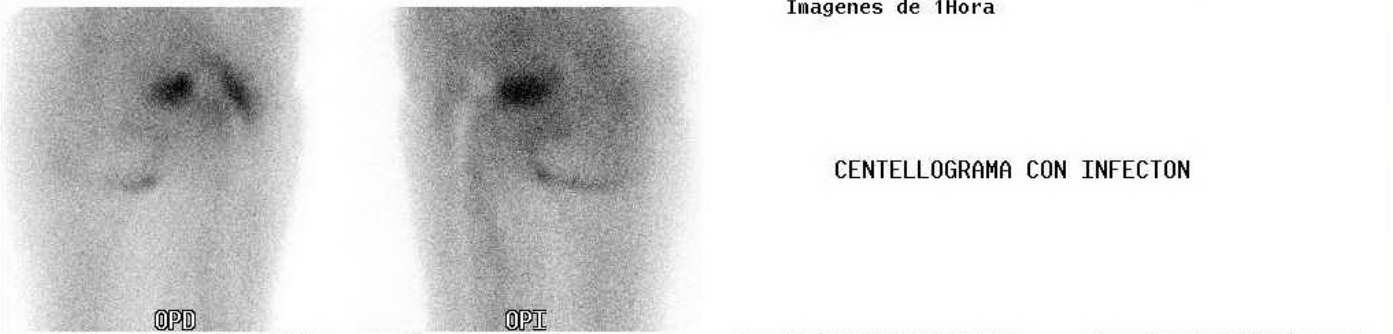


2da. Fase: Precoz

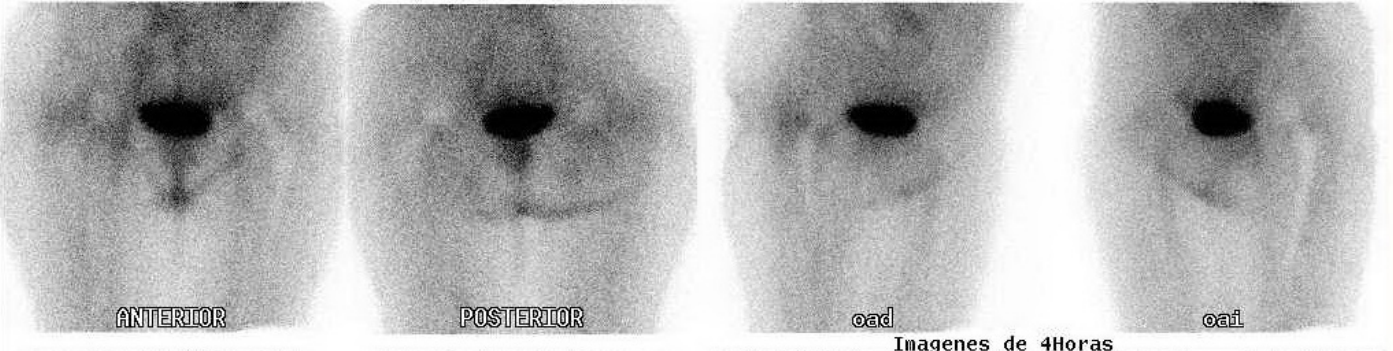




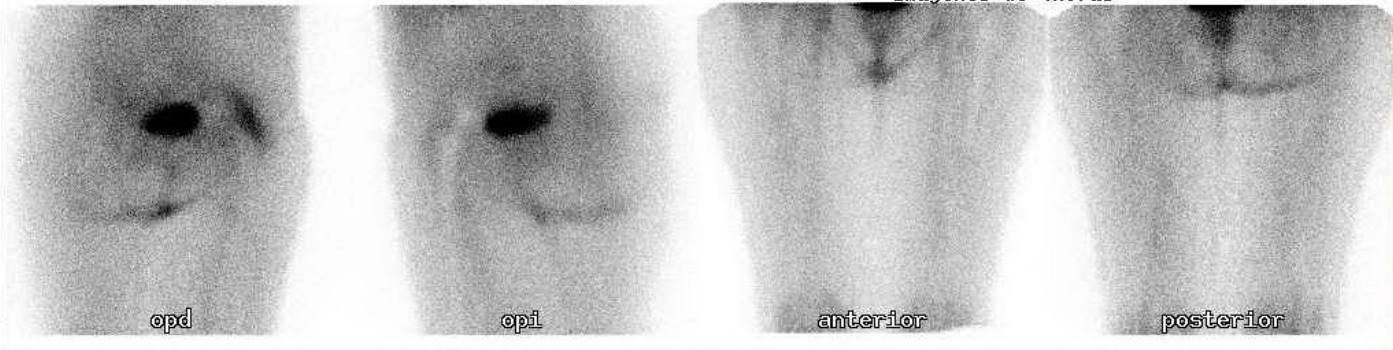
Imágenes de 1Hora



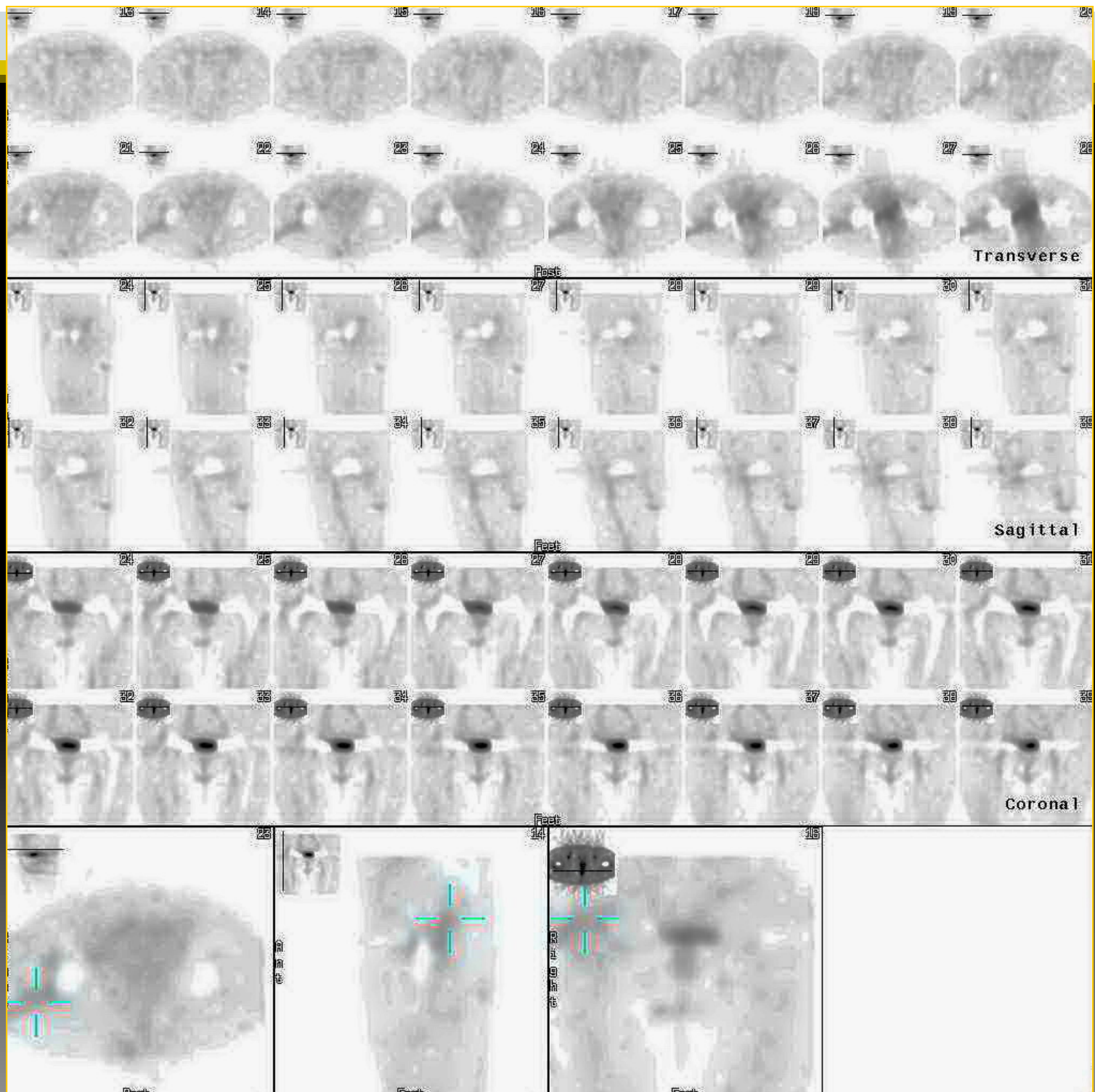
CENTELLOGRAMA CON INFECTON



Imágenes de 4Horas



4 h



Statistics for One Image Only:

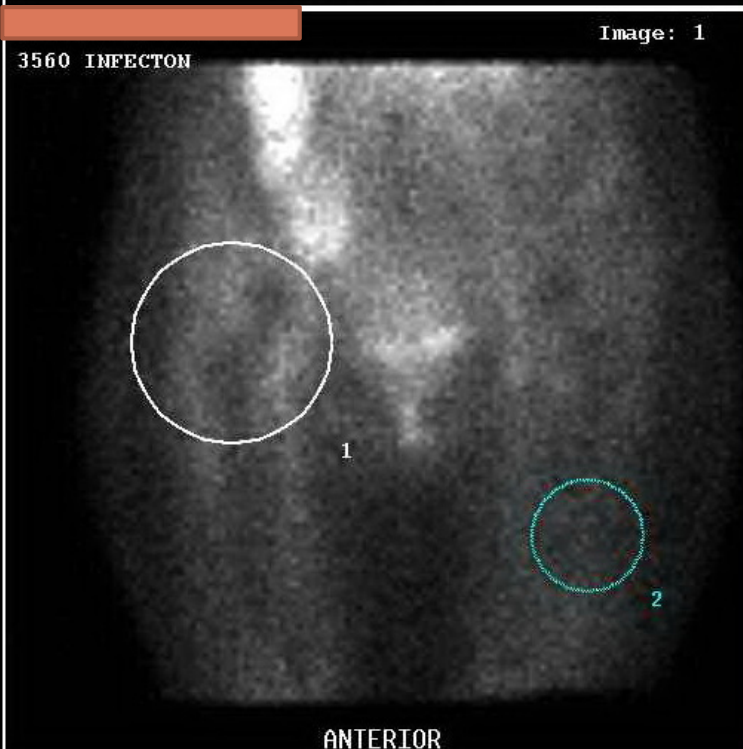
REGION NUMBER	REGION TOTAL	REGION PIXELS	REGION CTS/PIX	REGION MAX	REGION MIN
1	88762	848.8	104.6	197	30
2	10318	150.1	68.8	90	43



Rel 4h: 8.6

Statistics for One Image Only:

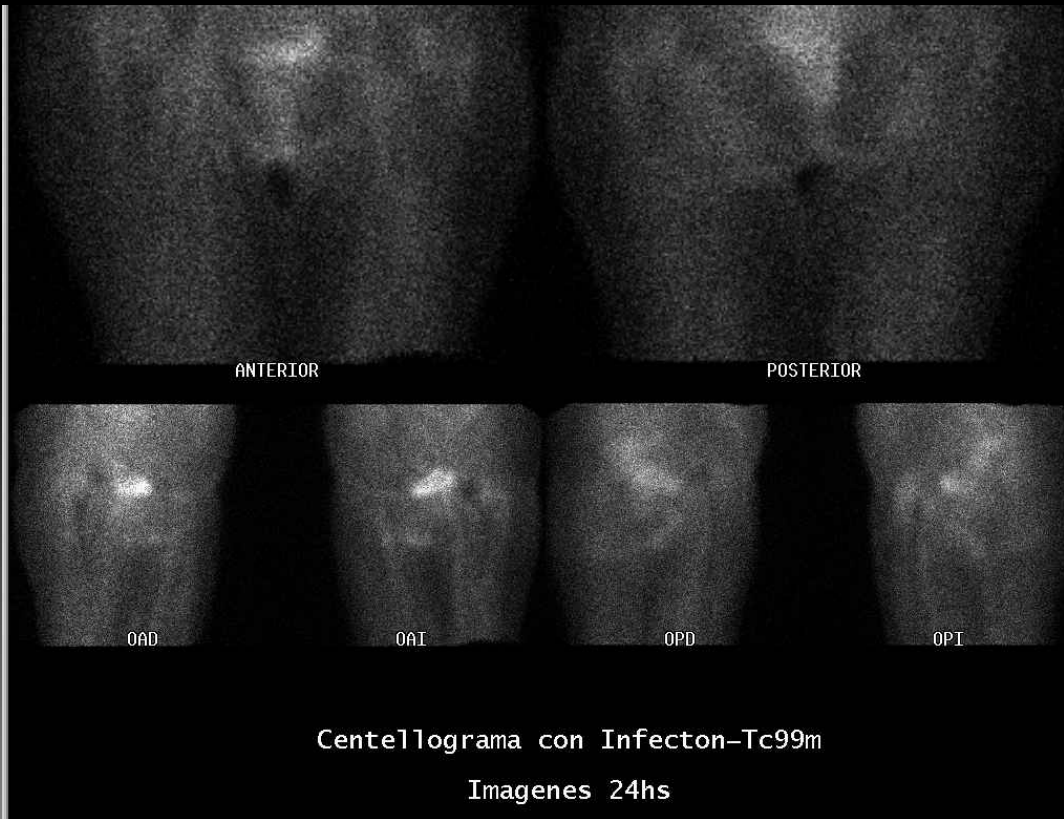
REGION NUMBER	REGION TOTAL	REGION PIXELS	REGION CTS/PIX	REGION MAX	REGION MIN
1	40228	902.3	44.6	93	12
2	7338	281.8	26.0	44	11



Rel 24h: 5.5



No infection



Statistics for One Image Only:

REGION NUMBER	REGION TOTAL	REGION PIXELS	REGION CTS/PIX	REGION MAX	REGION MIN
1	63510	2990.2	21.2	48	3
2	62223	2894.2	21.5	50	5
3	44078	2712.2	16.3	33	3

1,43

Statistics for One Image Only:

REGION NUMBER	REGION TOTAL	REGION PIXELS	REGION CTS/PIX	REGION MAX	REGION MIN
1	47167	3932.2	12.0	31	1
2	43790	3501.2	12.5	32	1
3	34849	3810.2	9.1	25	1

1,23

BUONO MARIA LAURA IMAGEN DE 4HORAS Image: 1

ANTERIOR

InfoBox for Display 1A

BUONO MARIA LAURA

ID: 06053 INF

Sex: F

Birth: 0/0/0

Head First, Supine

Acq: 6/7/2011 18:13:09

Planar:

Inj Time: 18:09 Tc-99m

M.D.P. H/L: 6.02 hrs

Activity: 25.0 mCi

Heads: 1,2 Wins: 1

Start Angle: 179.5

Acq Matrix: 256 x 256

1 Images: Max Ct: 113

Collimator: LEHR-Par

Depth: 16

View Term: 1000 KCounts

File: L46

Image ID: Lightbox

Acq ID: INF 4HS

View: ANTERIOR;POSTERIOR

Slice: 1.64 mm

Win:100.0% Bas: 0.0%

PICKER PRISM2000XP

ODYSSEY FX830

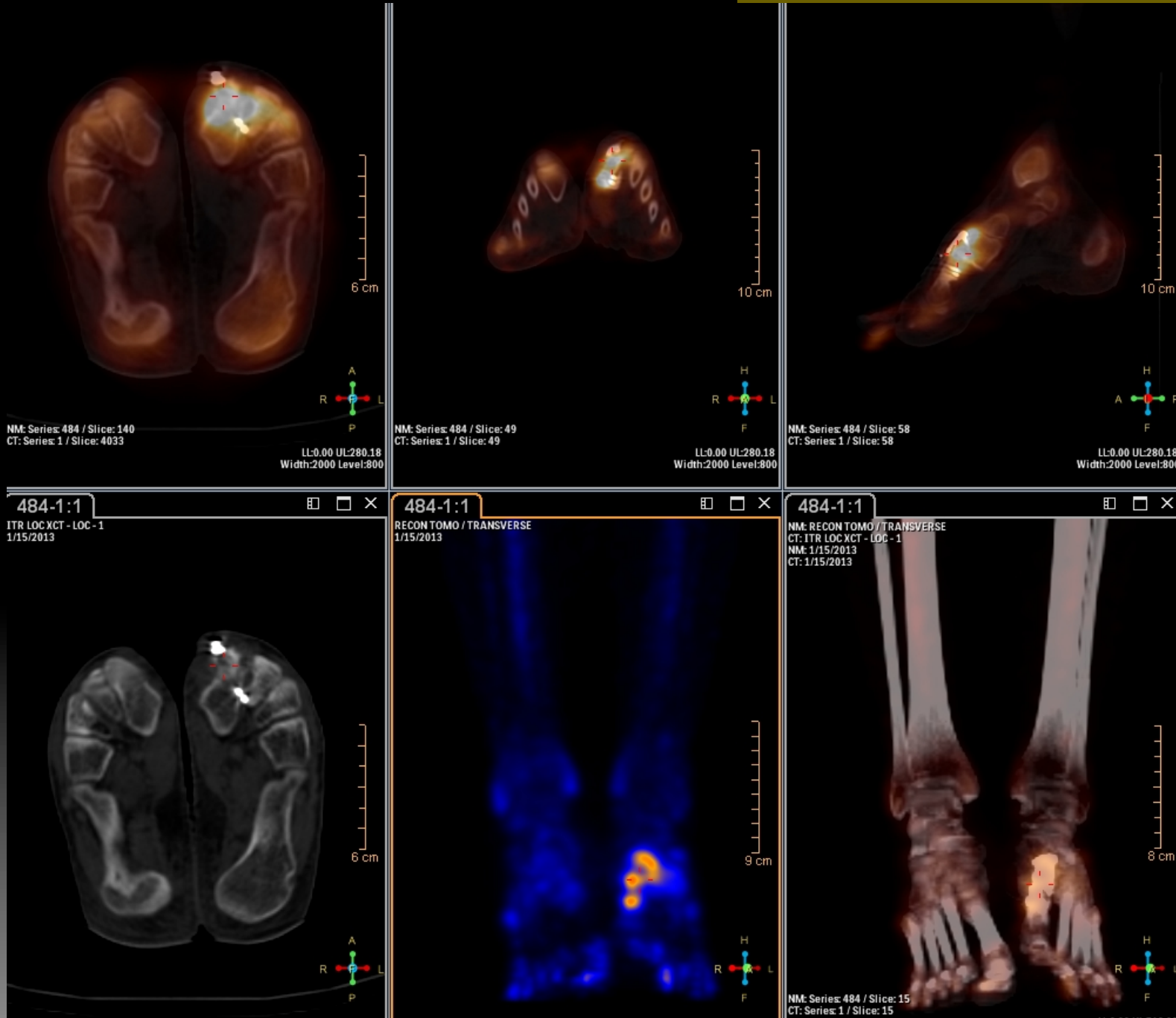
MEDICINA NUCLEAR

CENTRO DE DIAGNOSTICO DR. ENRIQUE ROSSI

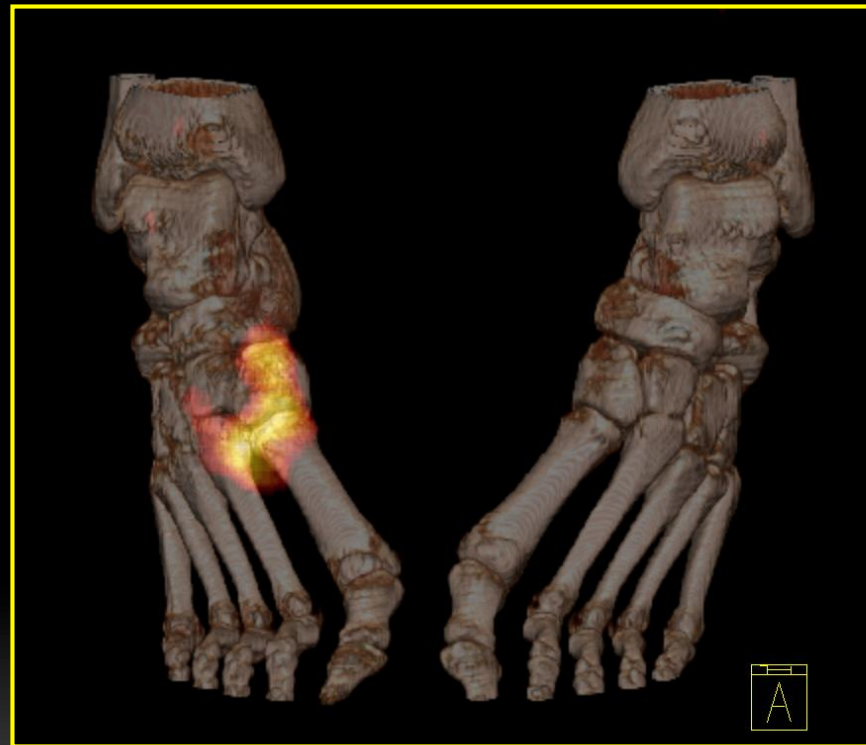
BUONO MARIA LAURA IMAGEN DE 24HORAS Image: 1

ANTERIOR

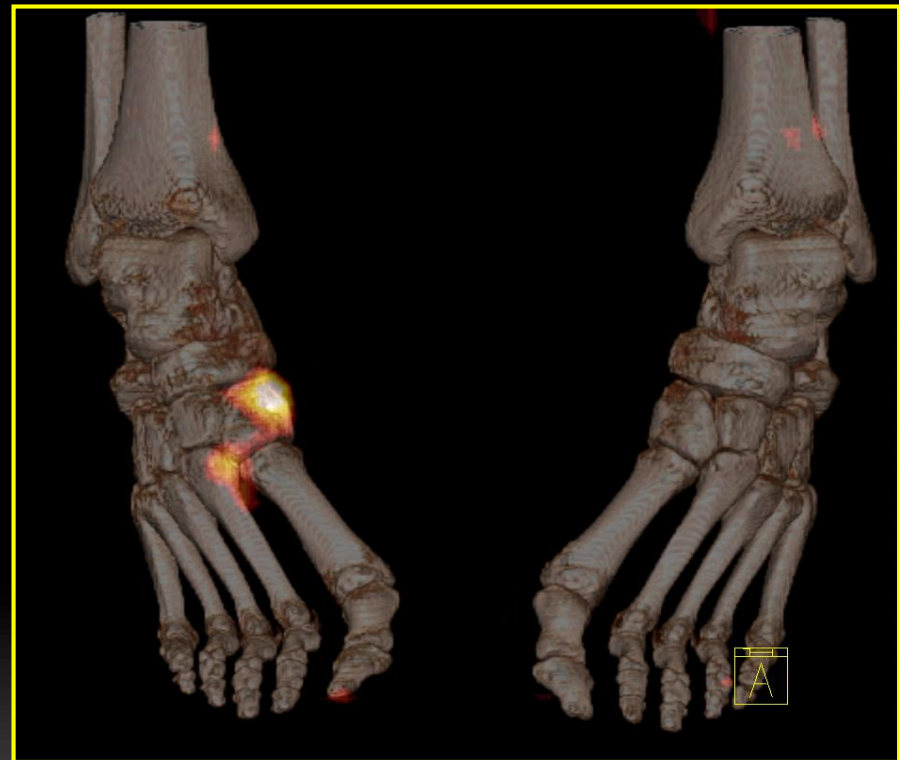
Osteomyelitis in L tarsal periprosthesis



Infecton SPECT/CT

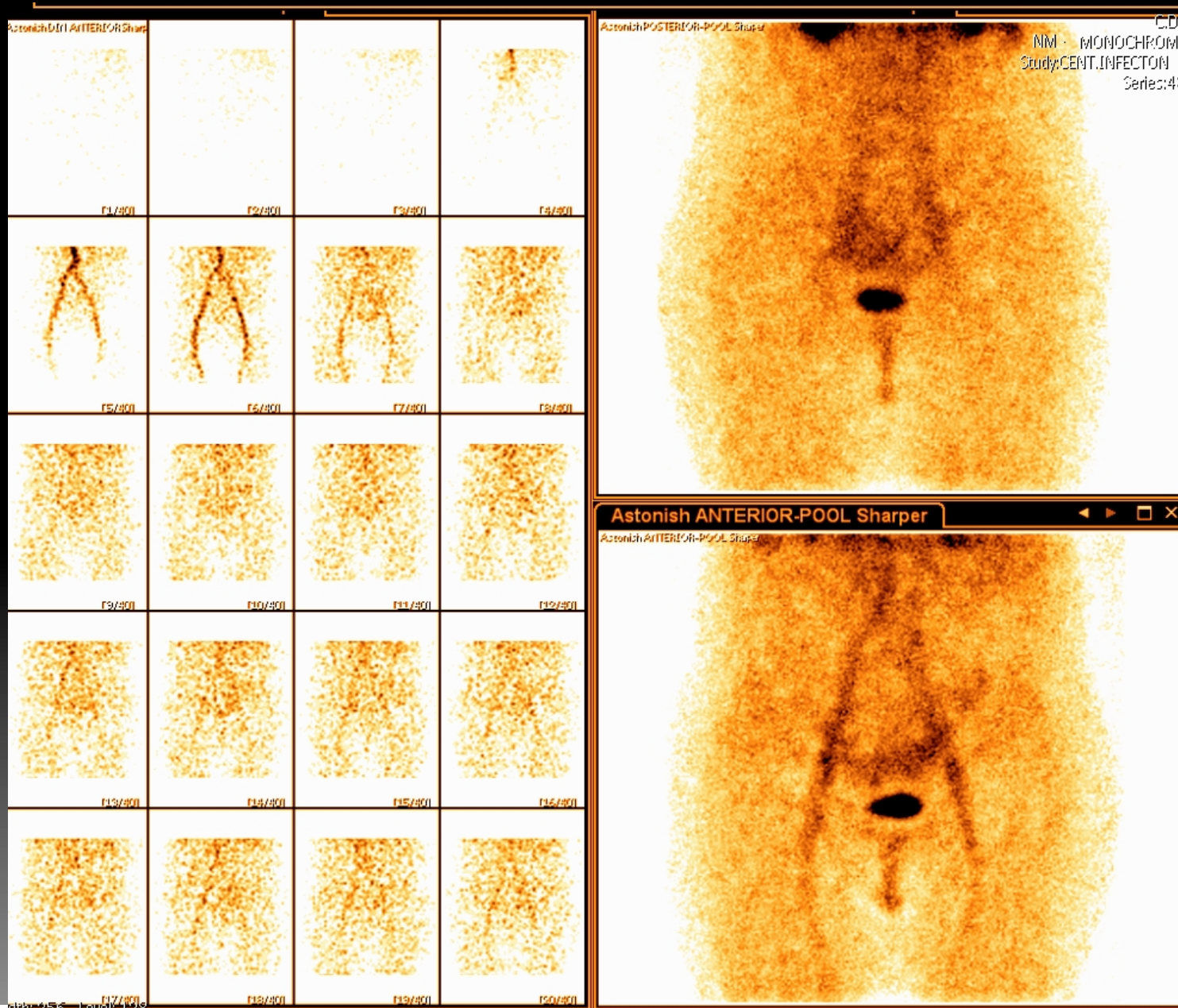


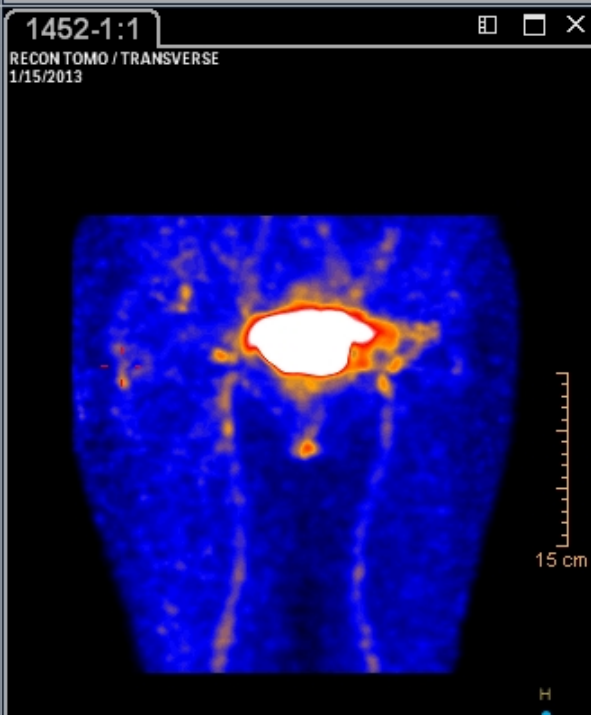
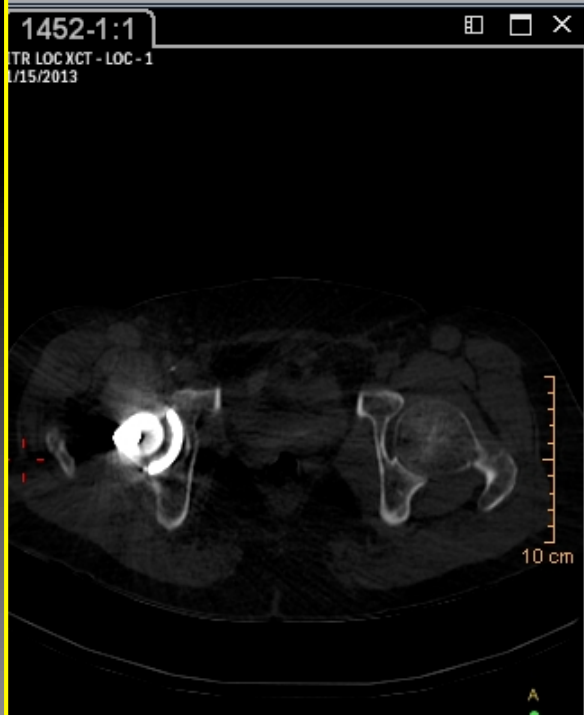
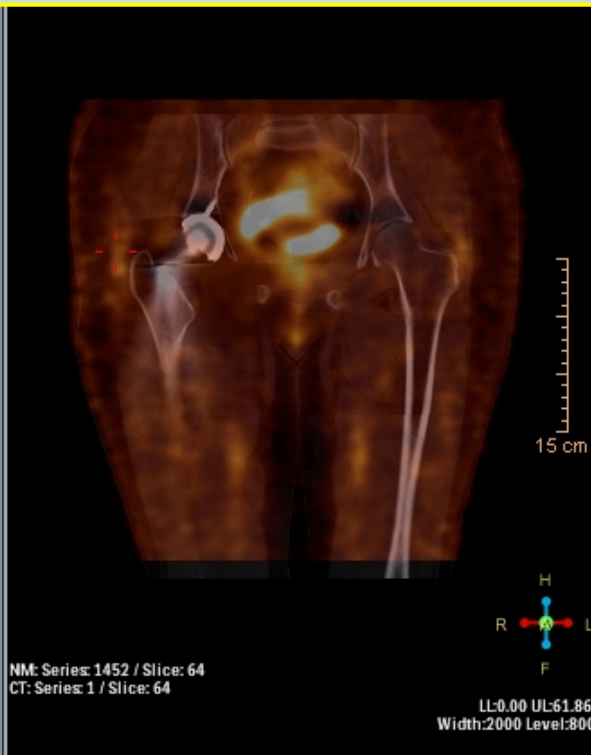
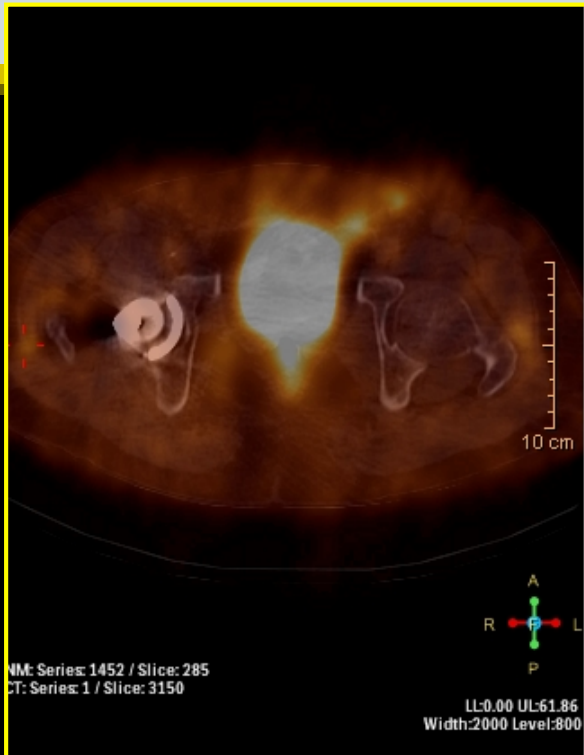
Baseline Infecton study



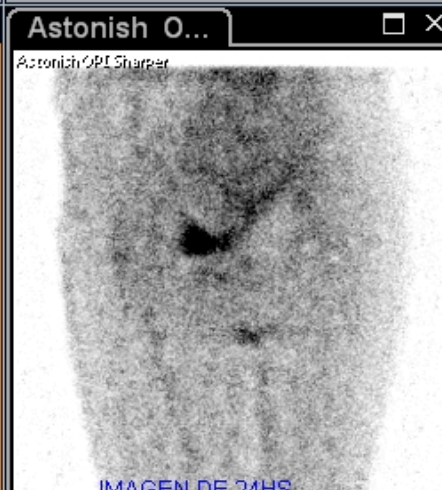
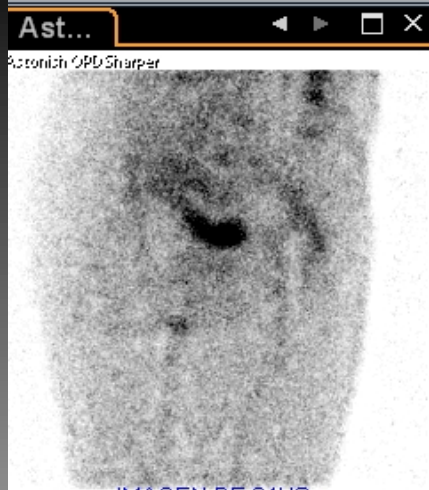
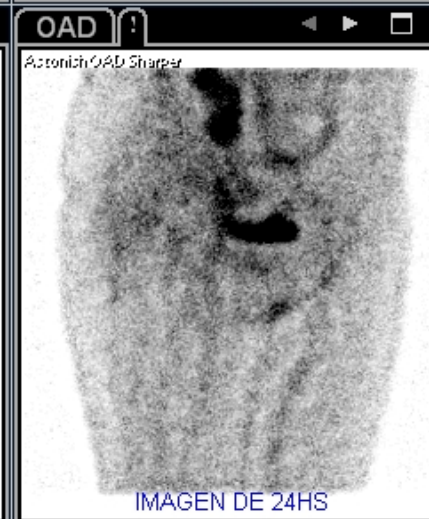
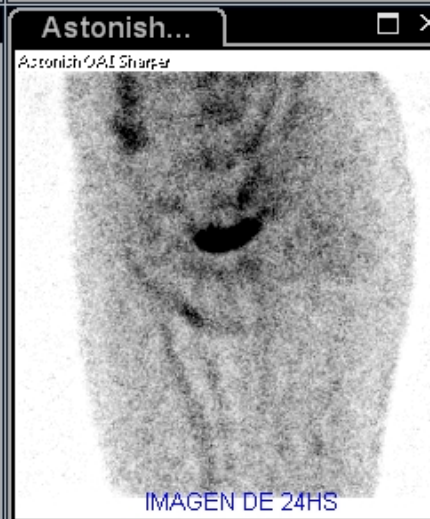
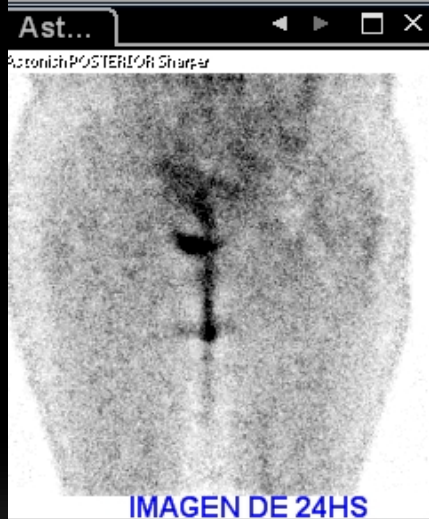
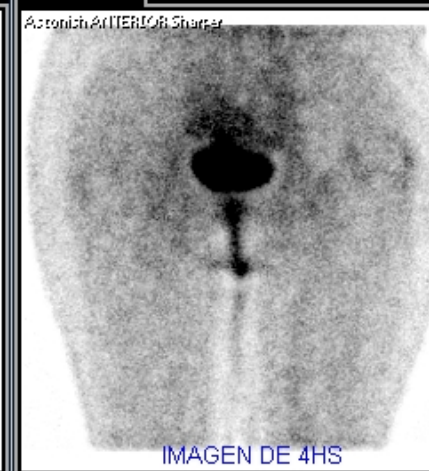
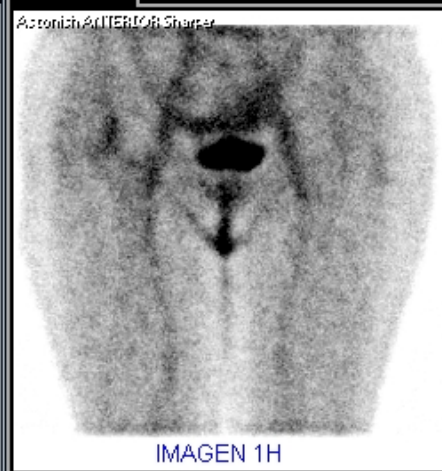
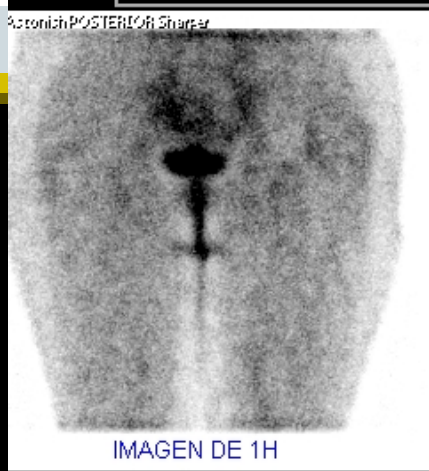
Follow-up after 16 weeks

Painful right hip replacement





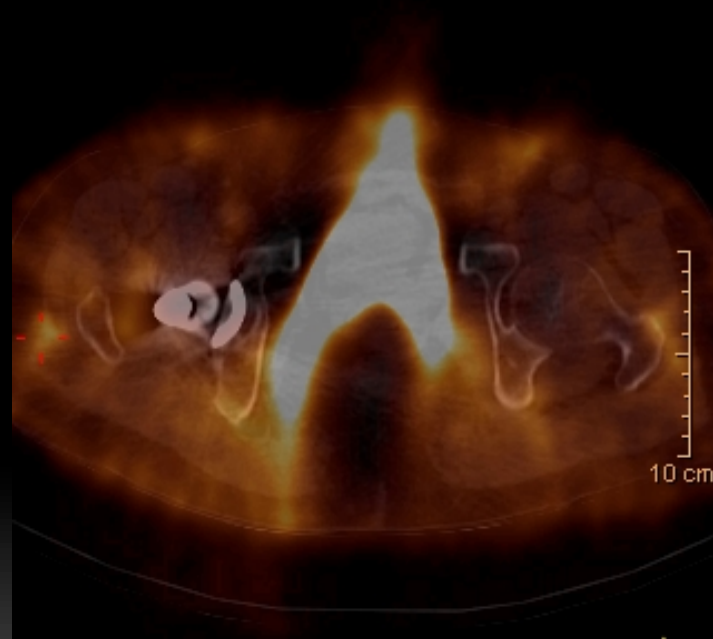
1h



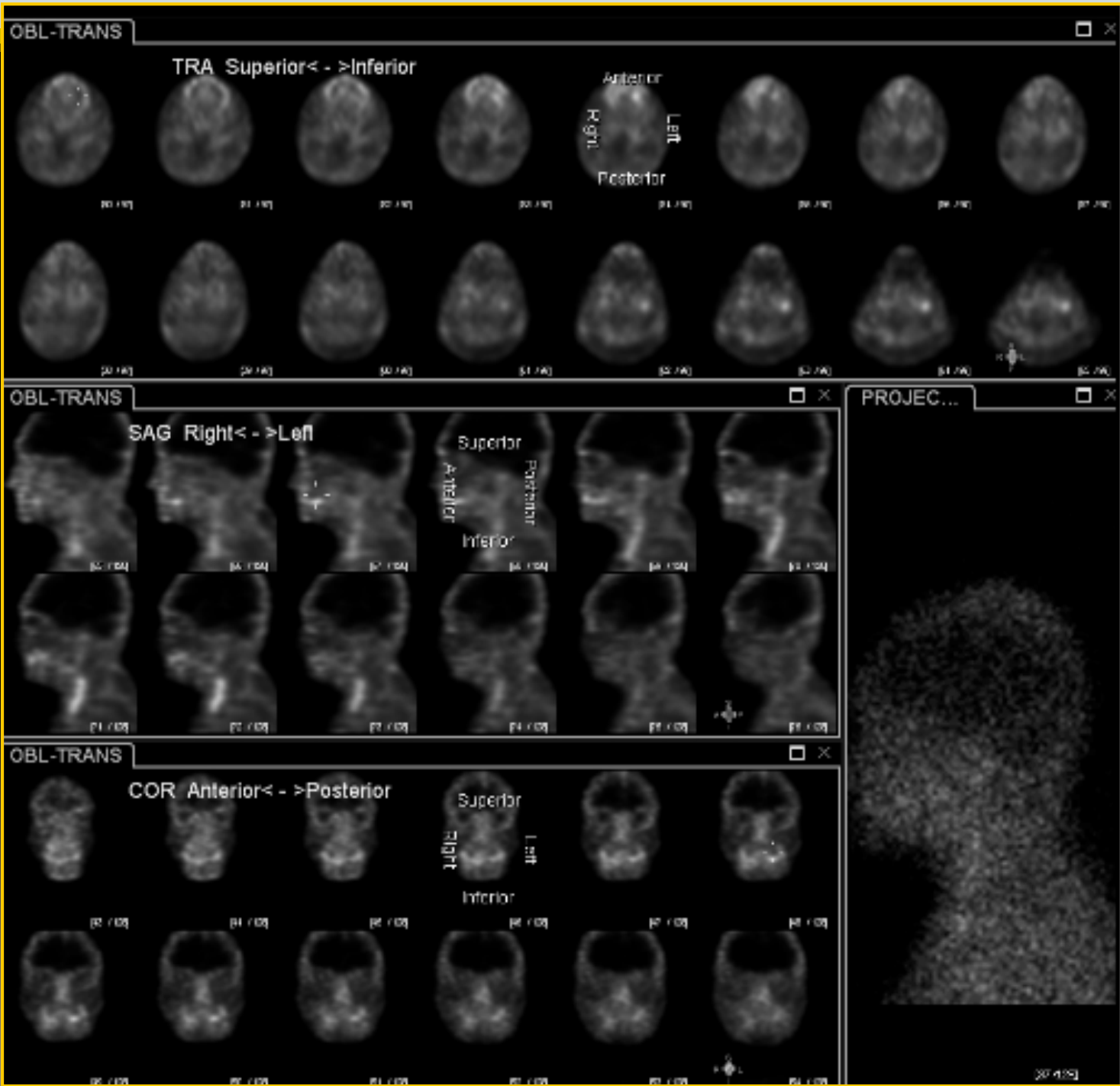
Planar 1, 4 & 24h

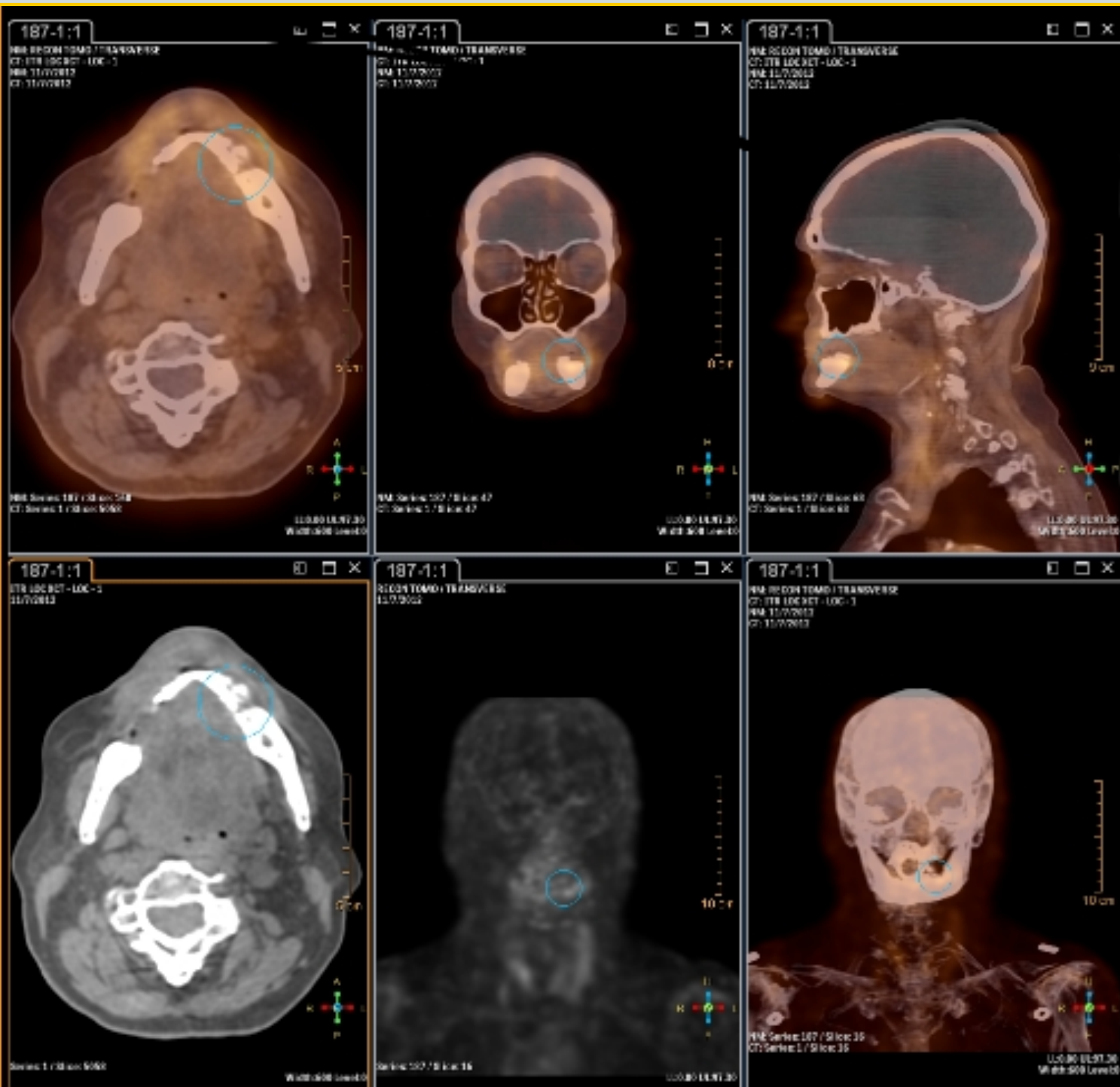
CT: 1/15/2013

IMAGENES DE 4HS

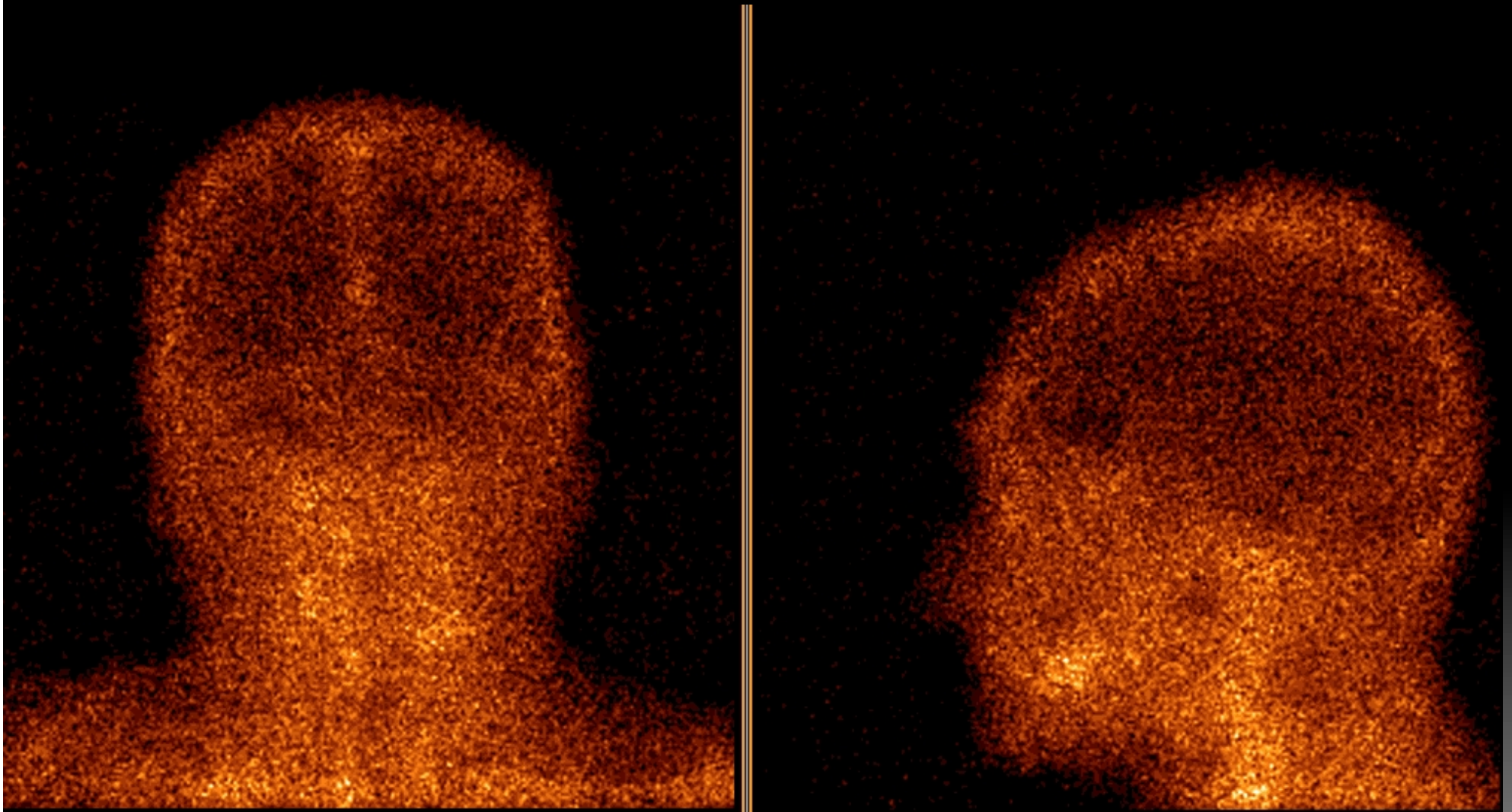


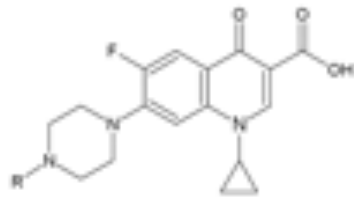
Chronic osteomyelitis of left inferior
maxilar





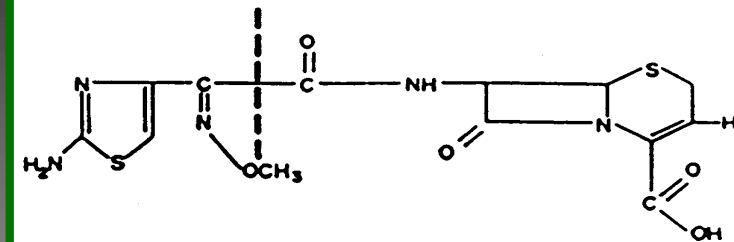
24h





4-fluoro-quinolone detects acute & chronic infections Gram (+) as well as (-) *Infecton*

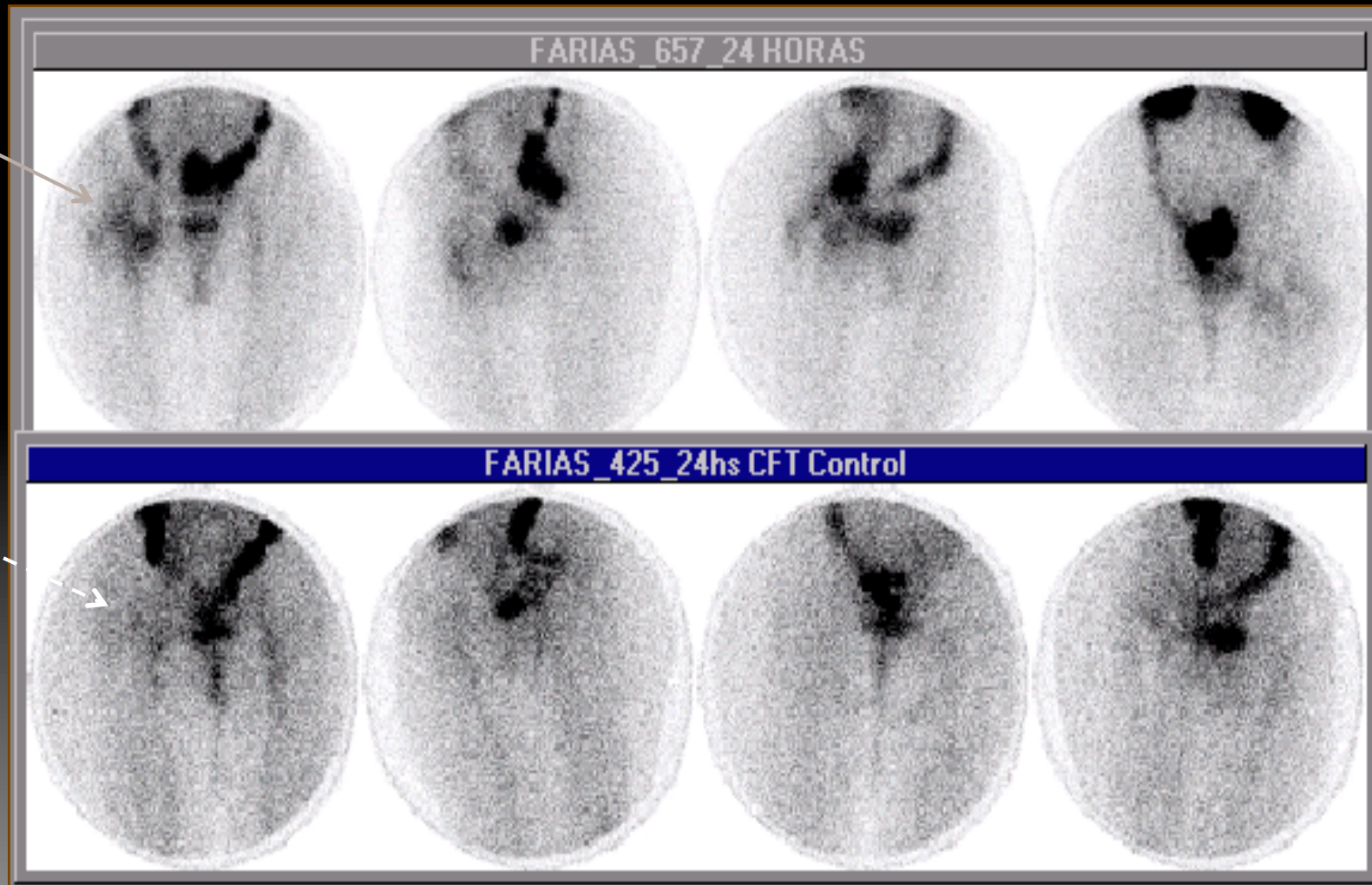
With Prof J. Martin-Comin (BARCELONA) we have labelled & used Ceftizoxime-Tc99m (*CFT*) 3erd generation antibiotic- cefalosporine





CFT-Tc99m 4h
biodistribution +
septic arthritis in right
shoulder

Value of the diagnostic & follow-up study (3 months later) with CFT-Tc99m



*Antibiotic scan

- No adverse reaction, during or after the scan reported in 15 years of use.
- Persistent 24h hot area, with similar or higher counts was considered infected.
- Photopenic area surrounded by a hot rim was interpreted as infected focus + necrosis
- Bone marrow **is not** depicted with this radio-tracer

Future of *Antibiotic scan

The clinical situation should be taken in account when selecting the specific radioagent

Availability of the radiopharmaceutical & the possibilities in your facility.

The new hybrid instrumentation SPECT/CT opens diagnostic roads & more accurate site identification

IAEA has a Coordinated Research Project with Infecton, labelled leucocytes & SPECT/CT in a longitudinal study for complicated osteomyelitis with culture biopsy certification.

WHY switching to FDG-F18 PET/CT?

- Easy to perform
- Not difficult to obtain
- Answer in one or two hs
- High resolution images, sensitive fused to anatomical structures
- High negative predictive value

Against

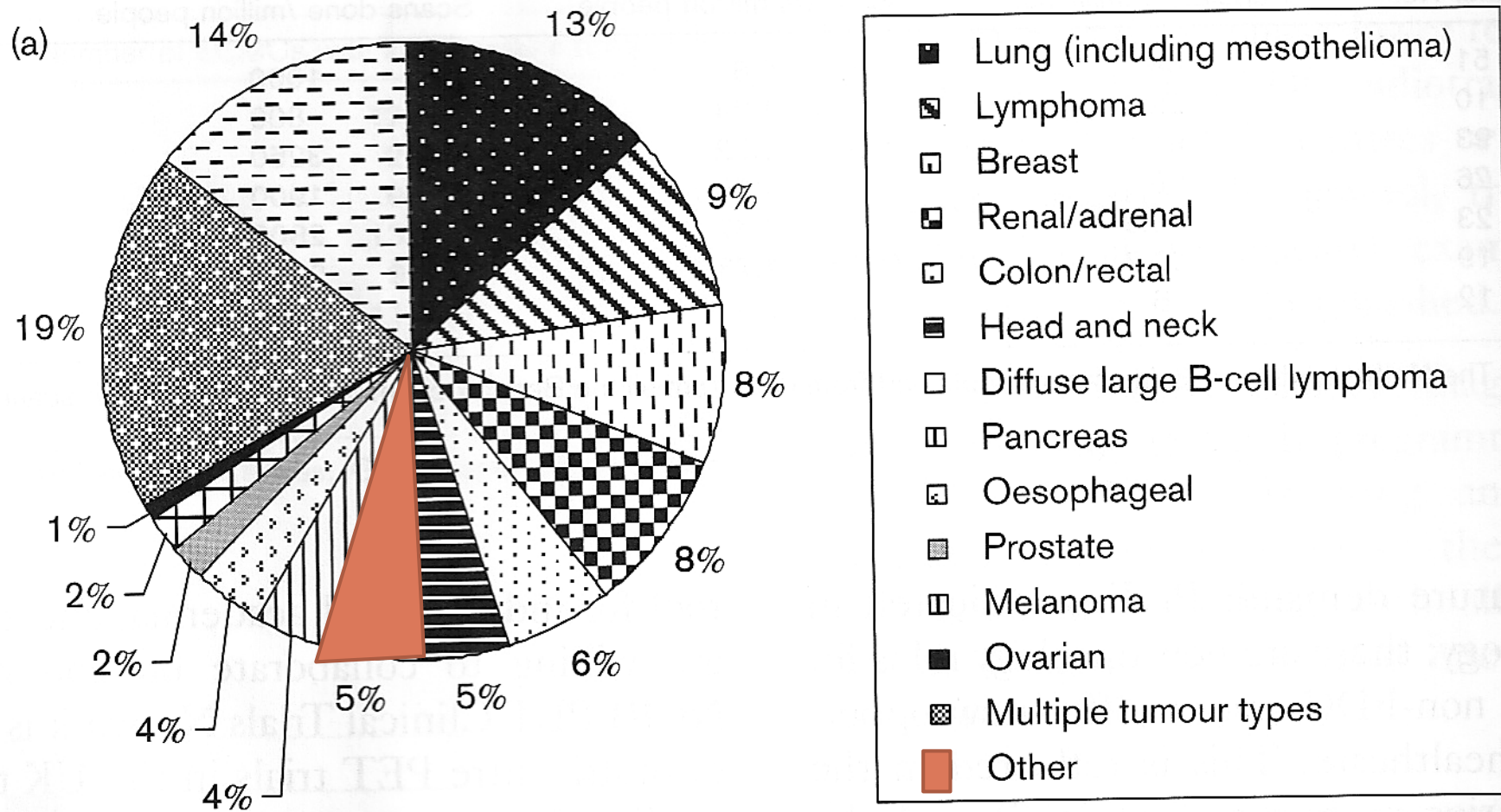
More expensive in my country
Availability??

^{18}F -fluorodeoxyglucose in inflammation / infection

↑ Cellular uptake

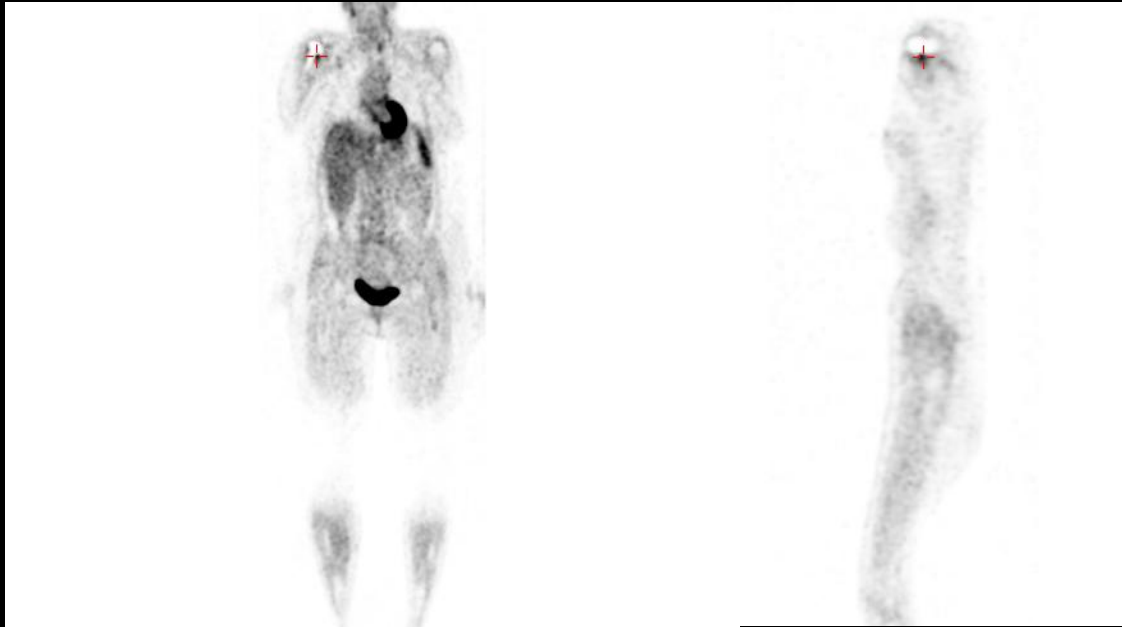
↑ Cellular metabolic rate & number of
glucose transporters

% Demand of infection/inflammation PET/CT studies

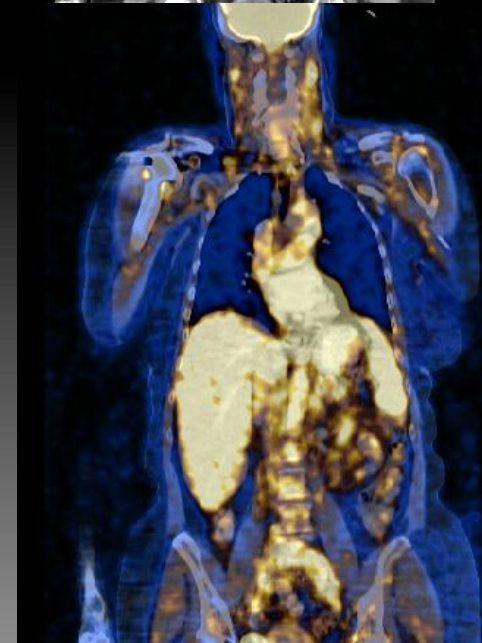
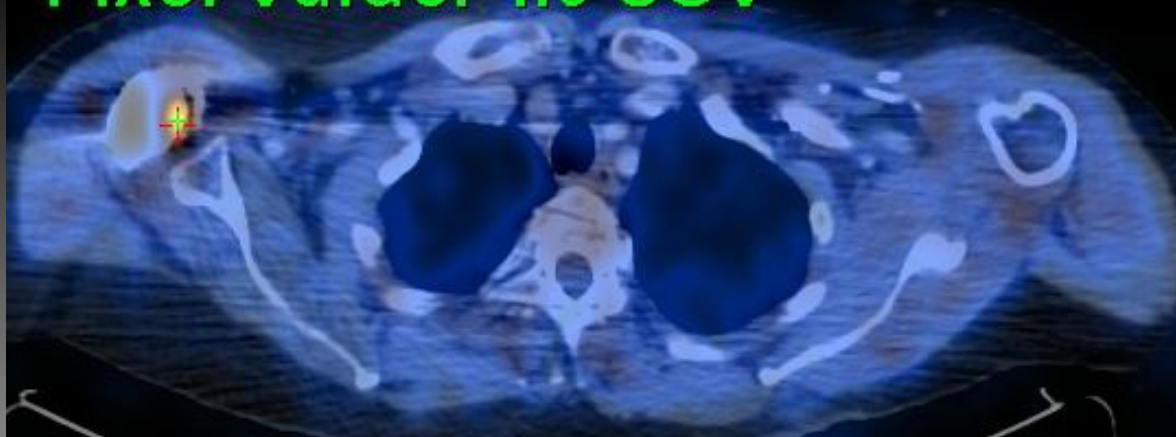


Peri prosthetic Infection humeral head-FDG-F18

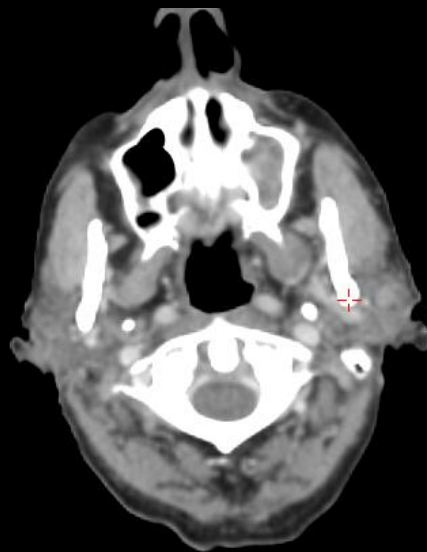
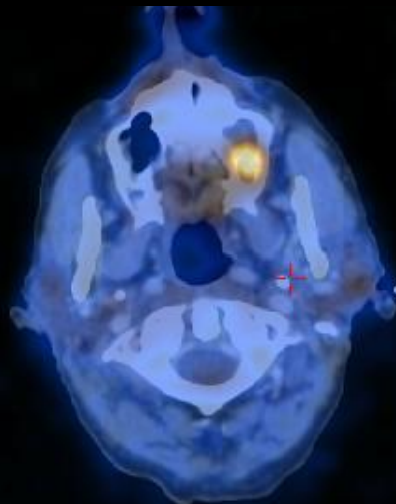
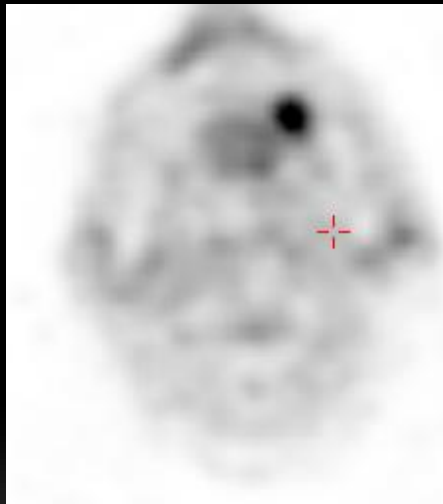
PET/CT



Pixel Value: 4.6 SUV



Micotic sinusitis in left maxilar sinus

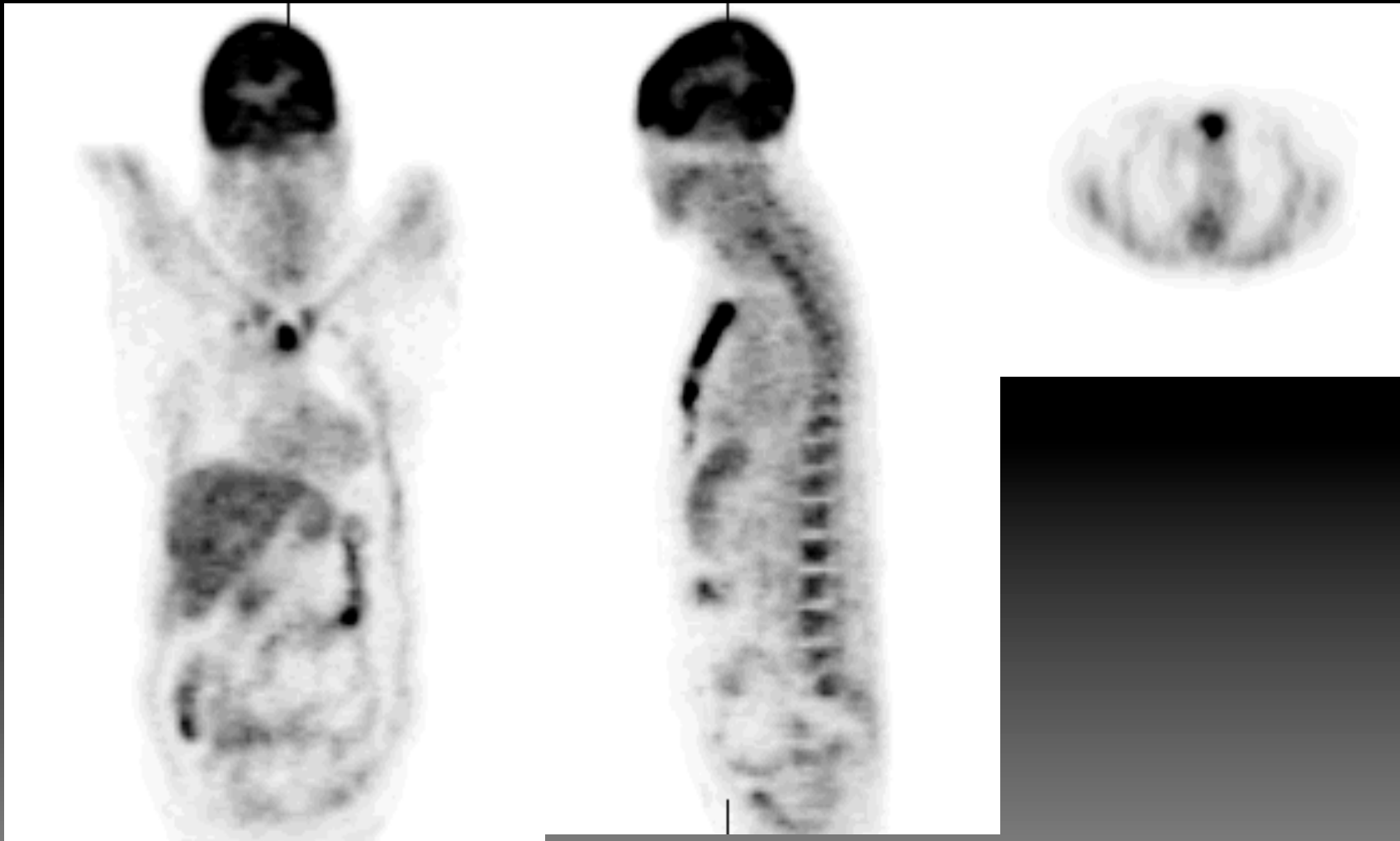


*Patient with prostatic CA+ melanoma
in right dorsal hand+ basocelular CA
in left subscapilar region*



Sarcoidosis

Sternum osteomyelitis

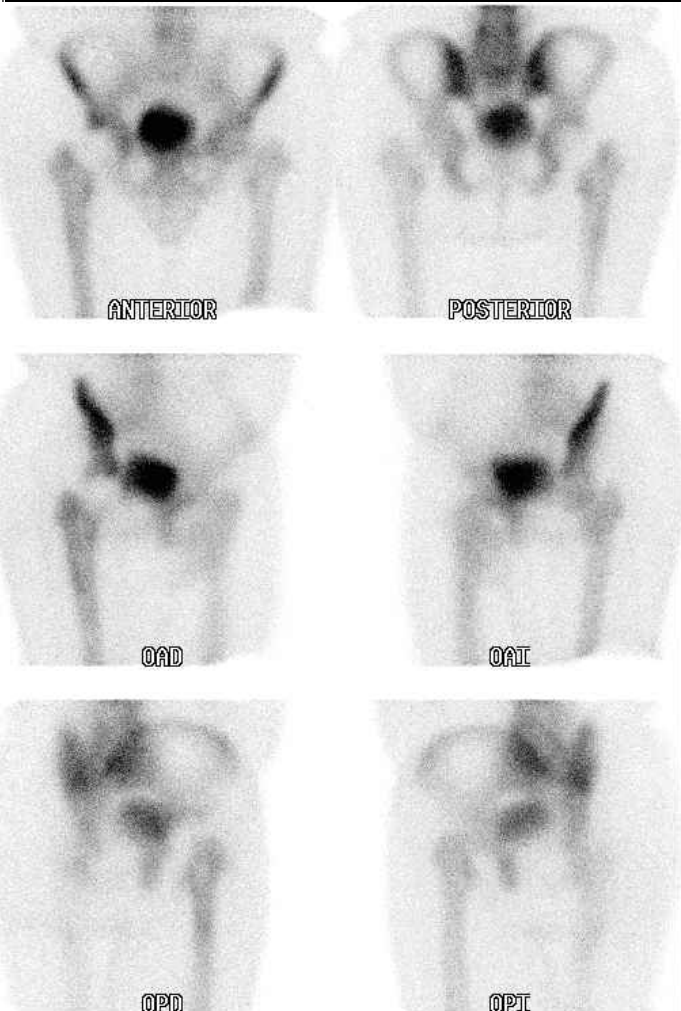
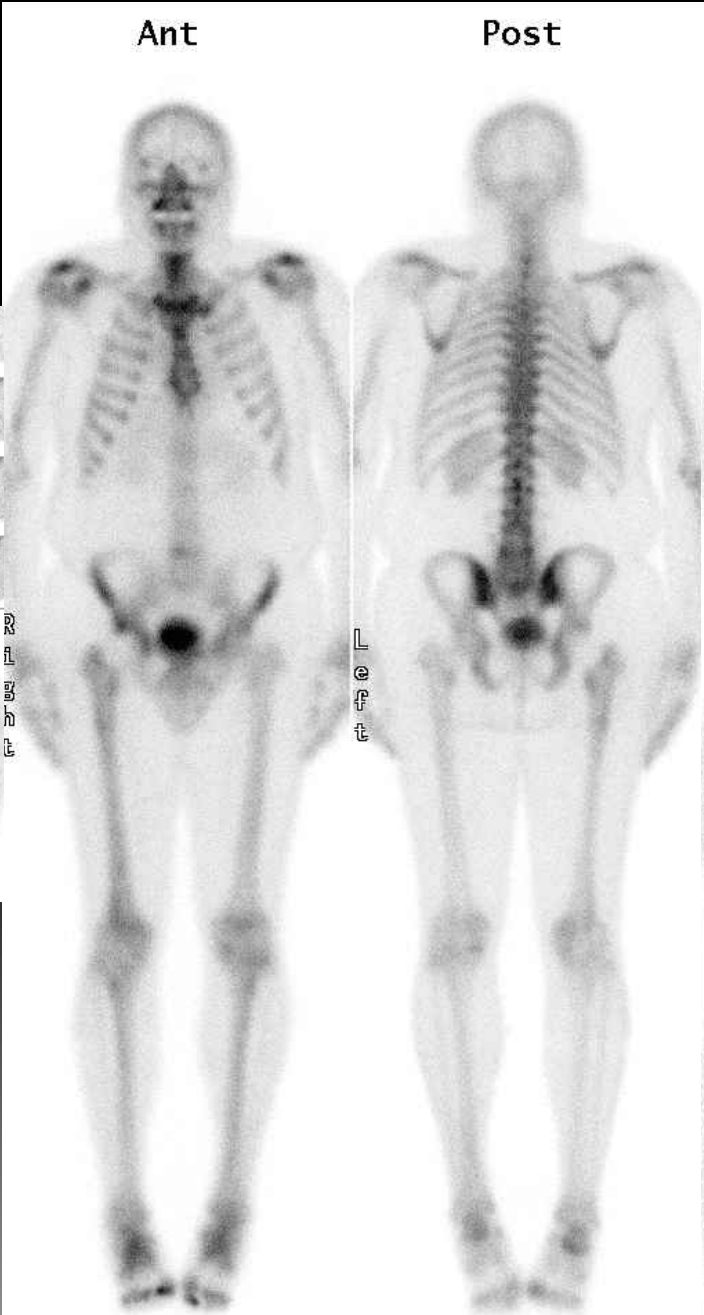
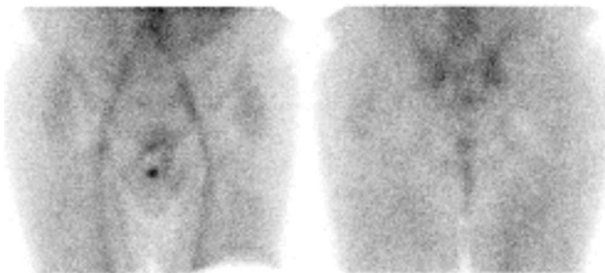
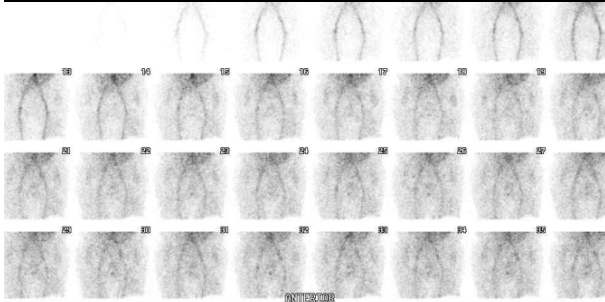


Infected peripheral vascular prosthesis

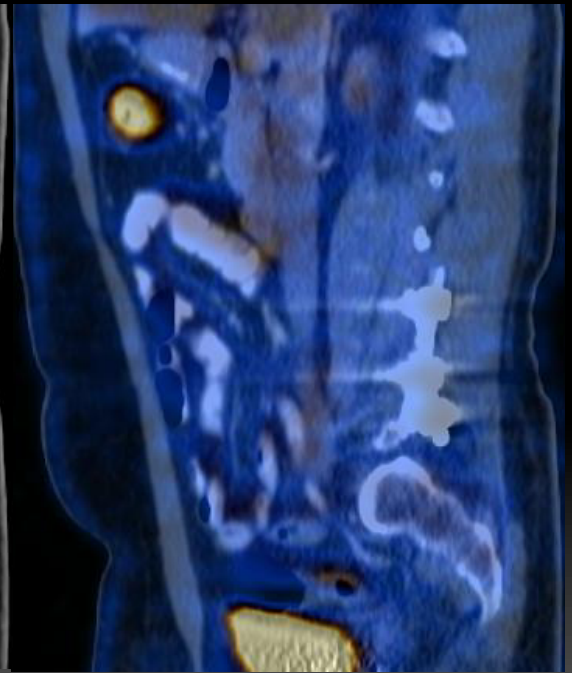


FDG-18 visualizes unstable atherosclerotic plaque





Infection, loosening?



FDG & the prosthetic painful hip replacements



Cortesy from F. Gemmel

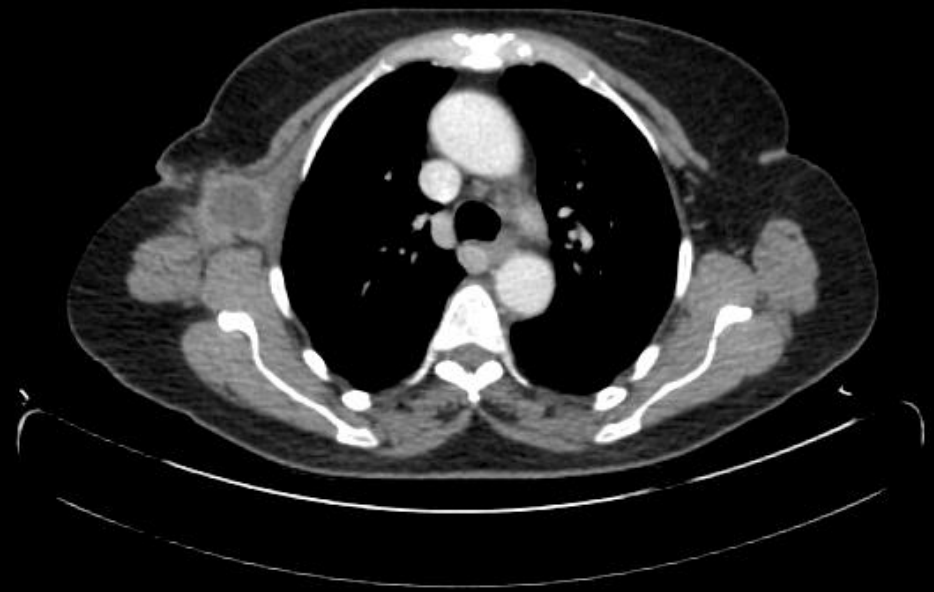
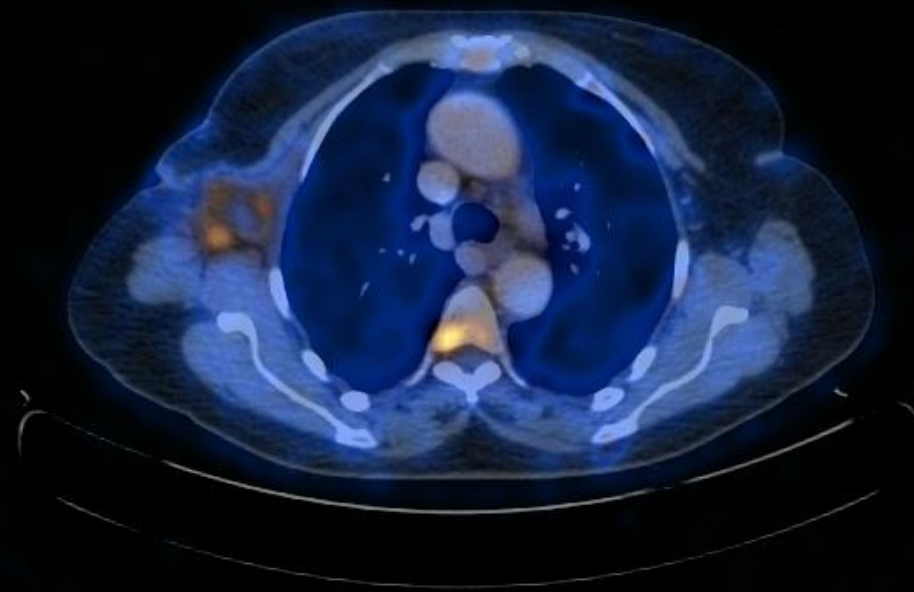
**Image of the month 2012, Eurp J.Nucl.Med &
Mol.Biolog- *K. Somazouglu***

FDG-F18



Leuc-FDG-F18

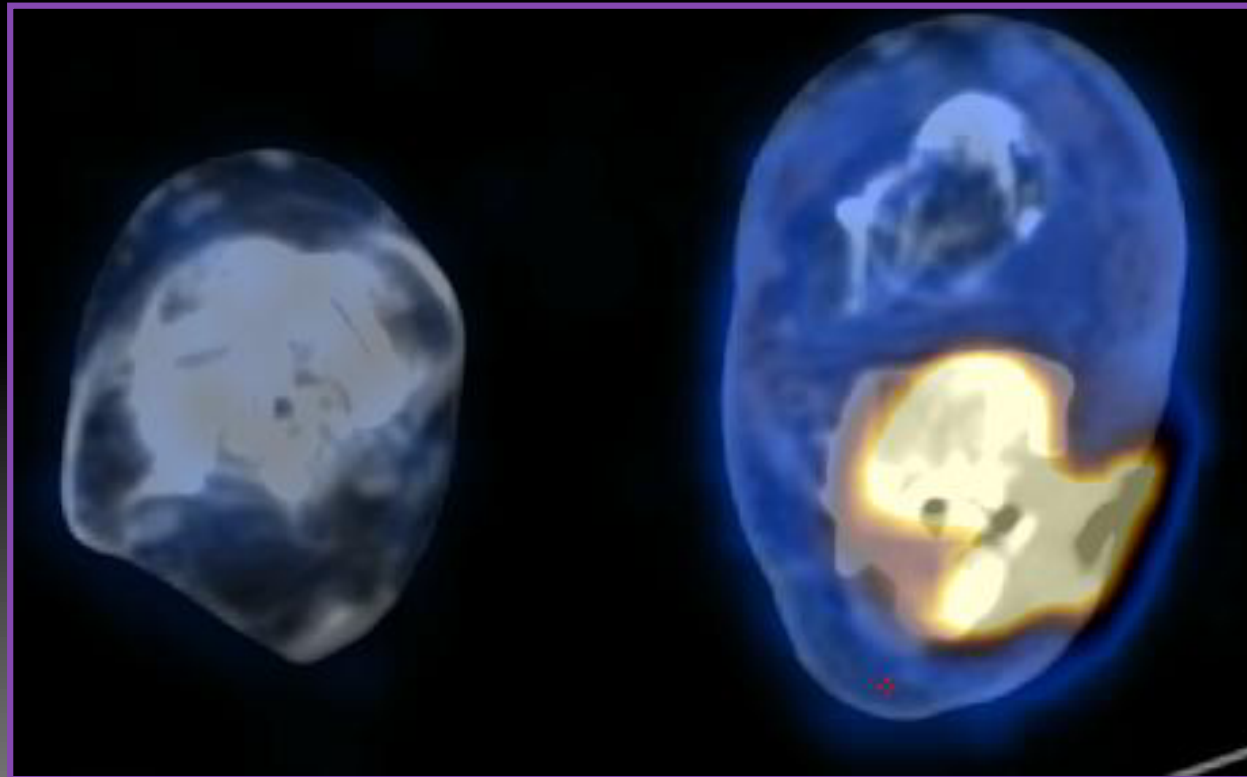


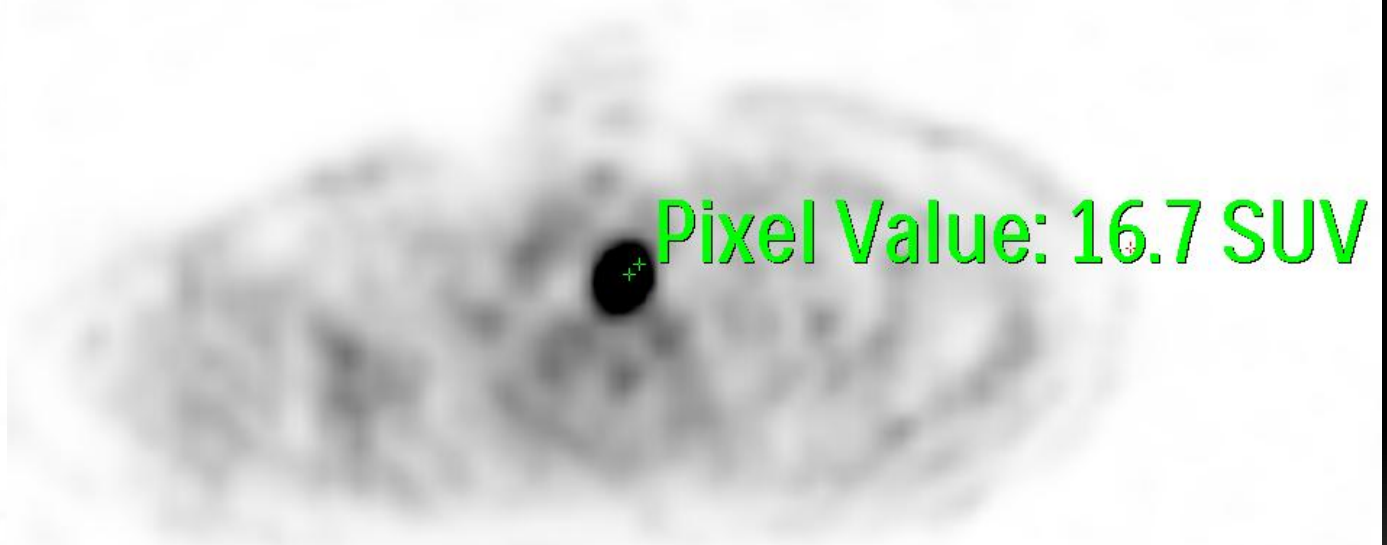
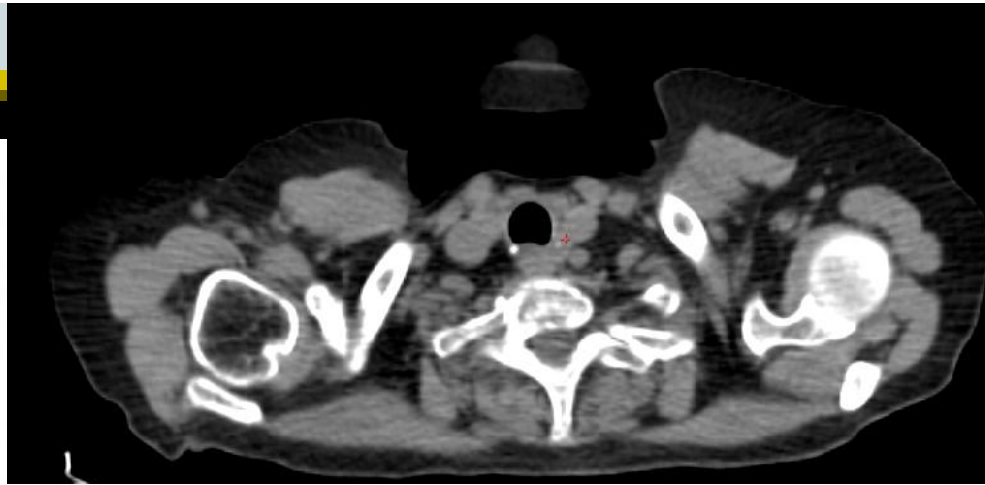


Axillary Abscess in a Breast carcinoma patient



Chronic INFECTION with malignant periferic tissue





Post-thyroidectomy: surgical granuloma

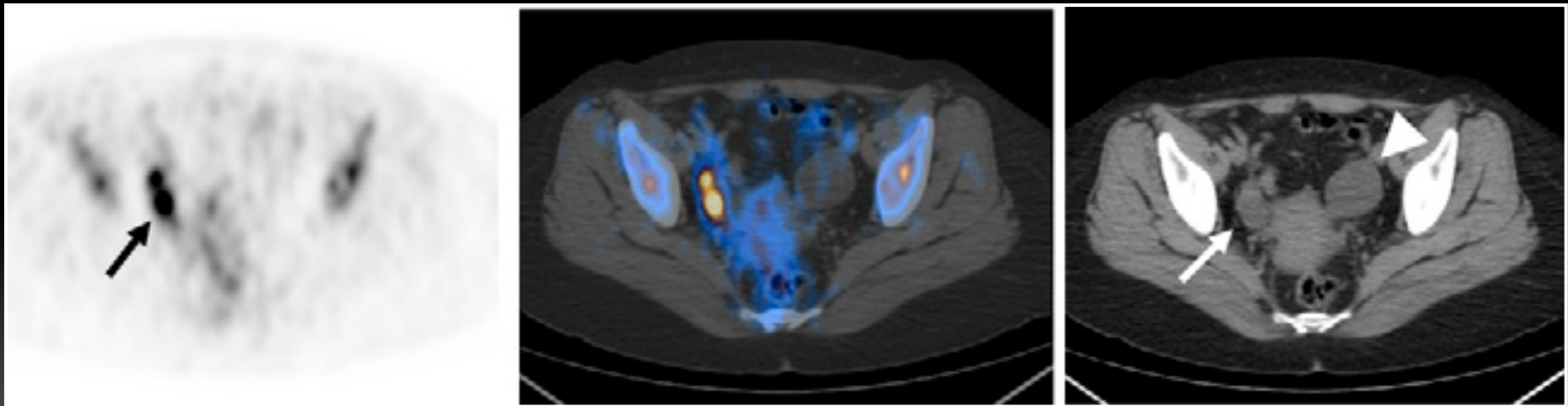
18F-FDG PET/CT for diagnosing infectious complications in patients with severe neutropenia after intensive chemotherapy for haematological malignancy or stem cell transplantation

Fidel J. Vos & J. Peter Donnelly & Wim J. G. Oyen & al-Eur J Nucl Med Mol Imaging (2012) 39:120-128

18F-FDG PET/CT scanning during chemotherapy induced febrile neutropenia is able to detect localized foci of infection and inflammation despite the absence of circulating neutrophils.

Besides its potential role in detecting Central Venous Catheter-related infection during febrile neutropenia, the high negative predictive value of 18F-FDG PET/CT is important for avoiding unnecessary diagnostic tests and therapy.

FUO : FDG-F18 localized abscess in right ovary



Palestro's statements from one of his talks at SNM:

Future:

Continued investigation of PET agents

In-vivo leukocyte labeling methods

ABOUT Infection specific tracers

No single agent was, is, or will be equally useful for all indications.

Is this landscape Antartida o Mars?



Is it Mars or Antartida? The same, we can doubt if the uptake is infectious, inflammatory, oncologic or a pitfall.

