

PÓS-GRADUAÇÃO 2013

PROCESSAMENTO DE IMAGENS MÉDICAS

APLICAÇÕES CLÍNICAS EM MEDICINA NUCLEAR

CLAUDIO MENEGHETTI

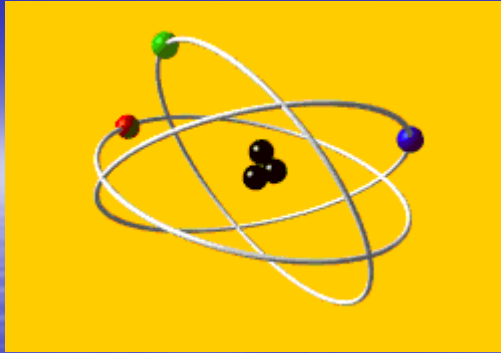
INCOR-HC-FMUSP

MEDICINA NUCLEAR :

“IN VITRO”: RIE

**PROVAS DE FUNÇÃO
MEDIDAS CORPÓREAS**

**“IN VIVO” : CINTILOGRAFIA ANATOMO-FUNCIONAL
CINTILOGRAFIA METABÓLICA**



MEDICINA NUCLEAR

- “*in vitro*” - radioimunoensaio
 - diagnóstico:
 - provas funcionais
 - teste de Schilling - ^{57}Co B12
 - sobrevida de hemácias - ^{51}Cr

“*in vivo*”

- diagnóstico por imagem
- terapia
 - tireóide - ^{131}I
 - dor óssea - ^{153}Sm

InCor

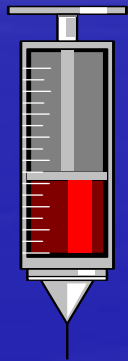
HC

VOLEMIA

SANGUE = PLASMA + GLÓBULOS

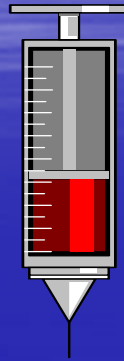
SANGUE = HTC% + PLASMA% = 100%

ALBUMINA ^{99m}Tc



Padrão

1 litro



Paciente

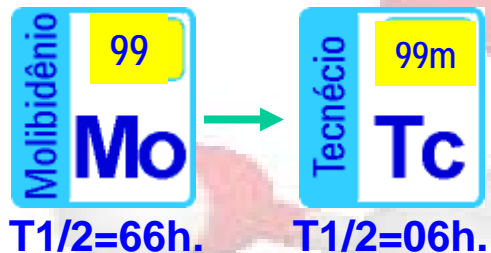
Sangue = X litros

1 ml padrão

1 ml paciente

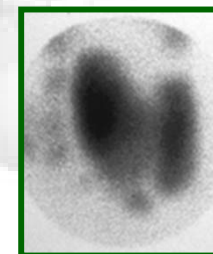
Poço
CPM

* estatística



Tecnécio 99m (^{99m}Tc)

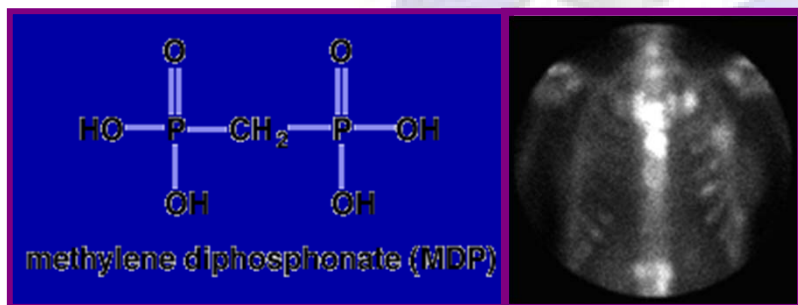
- Forma *livre* : $^{99m}\text{TcO}_4^-$



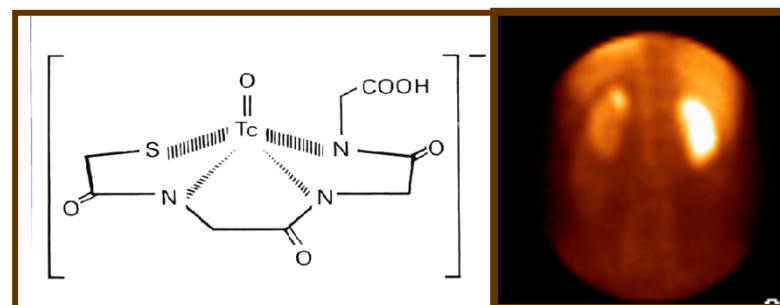
- Forma *marcada*

RADIOFÁRMACOS

Methylene diphosphonate
 “ ^{99m}Tc - MDP ”



Mercaptoacetyltriglycine
 “ ^{99m}Tc - MAG3 ”



RADIOFÁRMACOS

Controles químicos, físicos e biológicos.



Vias de administração:

- Venosa
- Inalatória
- Oral
- Sondagem Vesical
- Sonda Naso Gástrica

Dosimetria

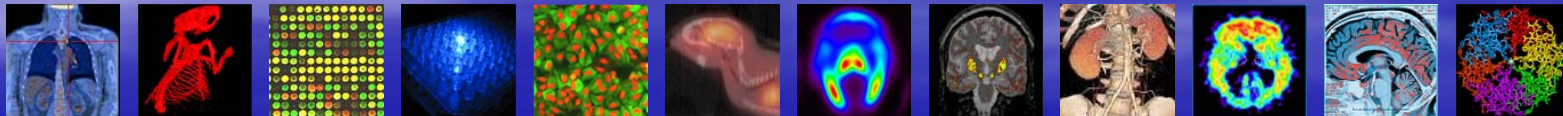
Cloreto de Tálcio-201

Dosimetria: (Rad/3.5mCi)	
corpo total	0.7
testículos	1.8
ovário	1.6
rins	4.2
intestino	0.9



CELL

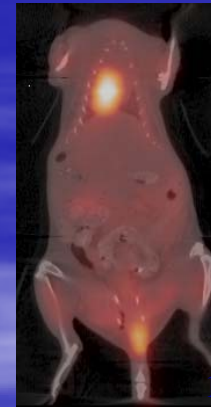
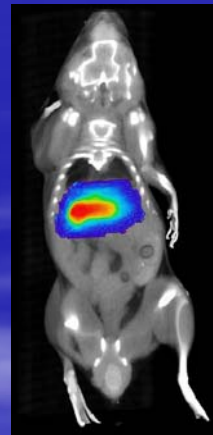
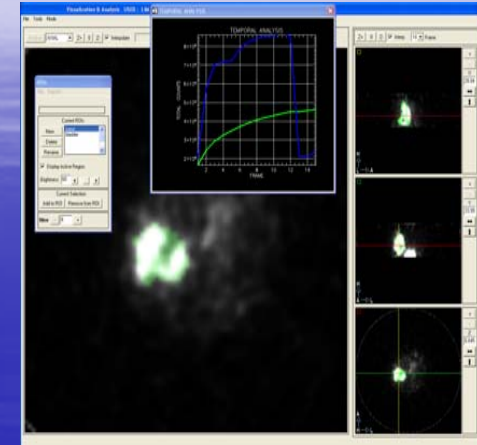
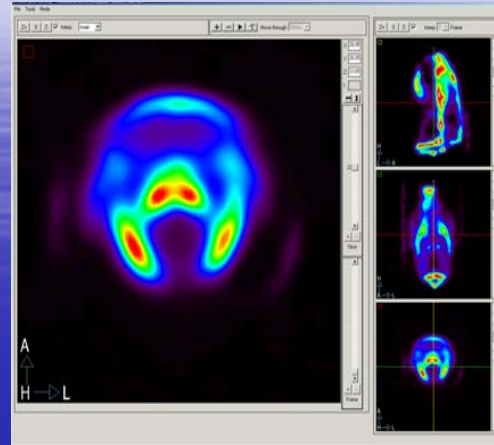
In-Vivo Imaging for Molecular Medicine



Pre-Clinical PET: eXplore



- High Sensitivity: >4%
 - High-resolution: 1.6mm
 - PET / CT Functionality
- Common Bed, Software Fusion



Triumph



SPECT

- CZT digital detectors
- interchangeable collimators

PET

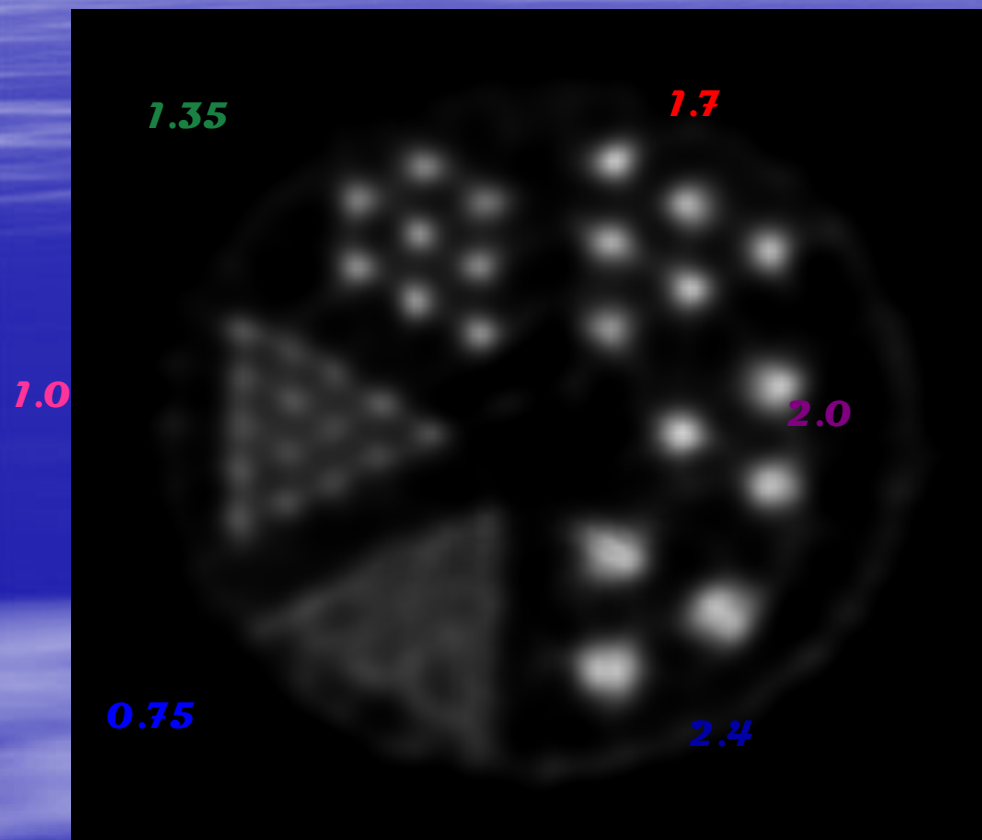
- digital PET detectors (APD)

CT

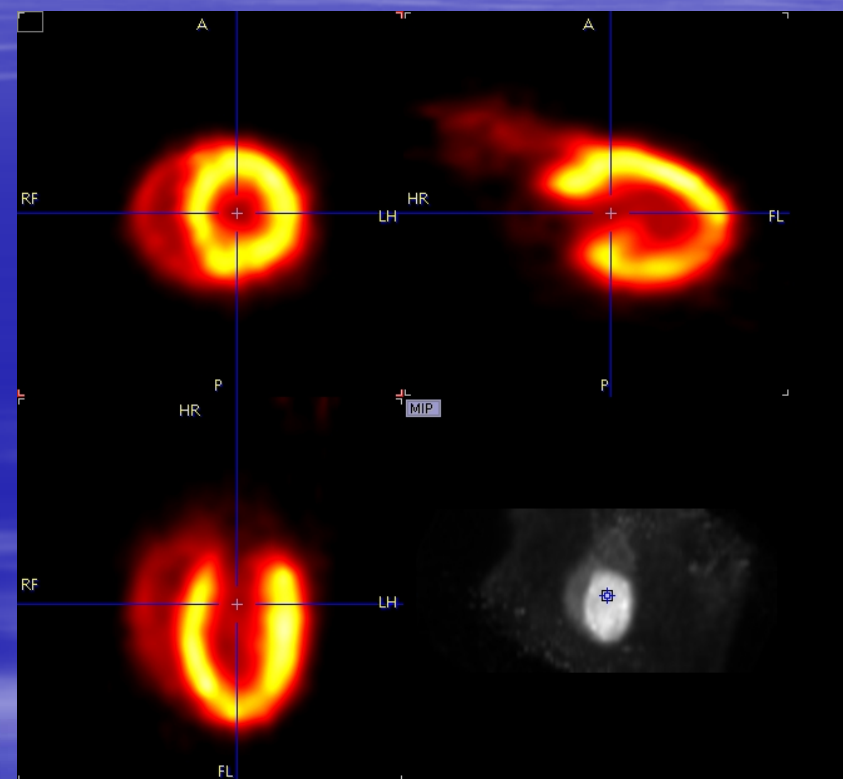
- sub-minute low-dose scanning in normal usage mode
- high resolution mode when desired

Resolution of LabPET

MicroDeluxe phantom



Mouse heart

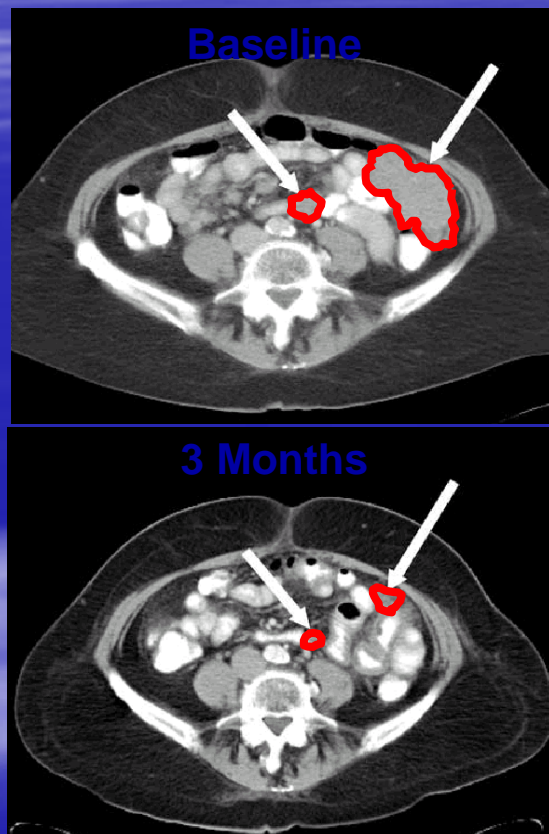


200 uCi FDG, 5 min acquisition

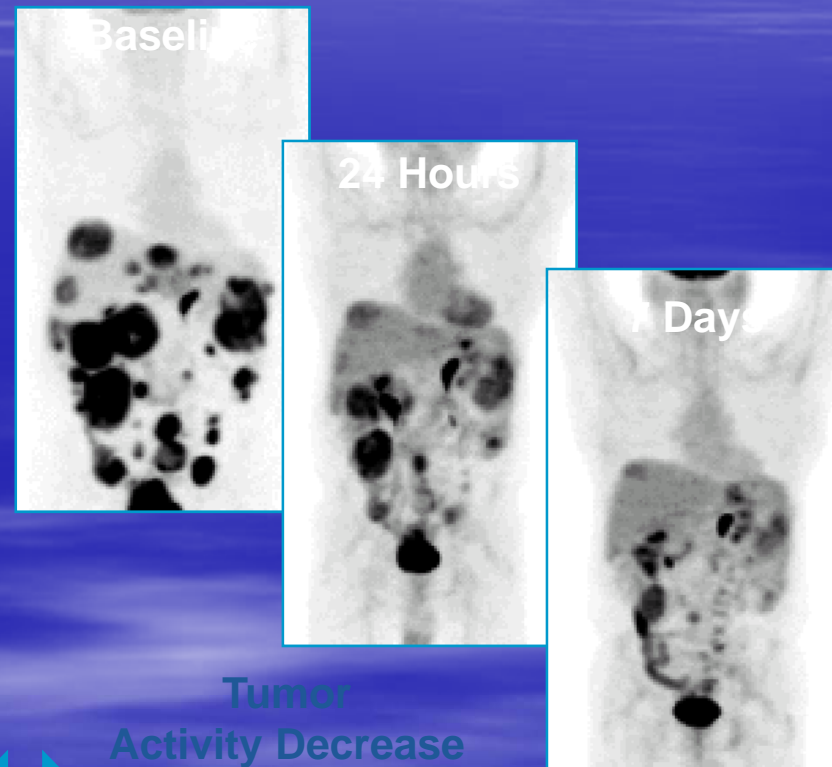
Large, low contrast items (large = low spatial frequency) do not show up if they have low contrast against background they may not be visible with PMT based systems whereas they are visible with APD based systems.

The Potential of Molecular Imaging – Cancer Therapy

Standard CT Anatomic Evaluation



PET – FDG Metabolic Evaluation



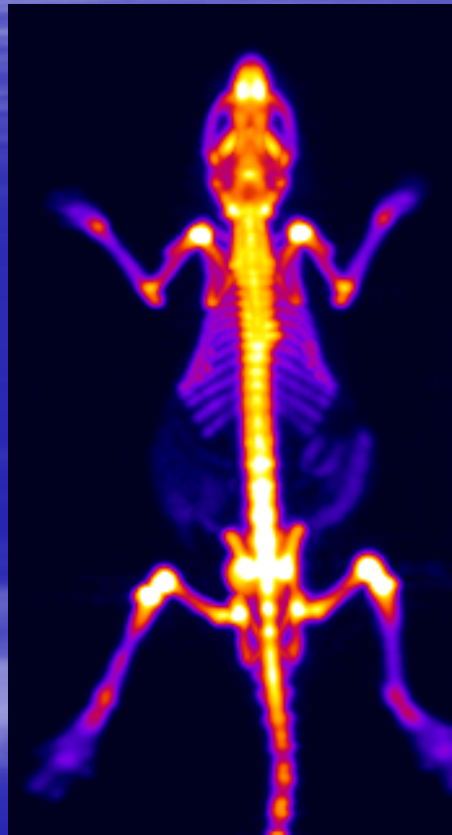
**Tumor
Shrinkage
Observed
After Months**



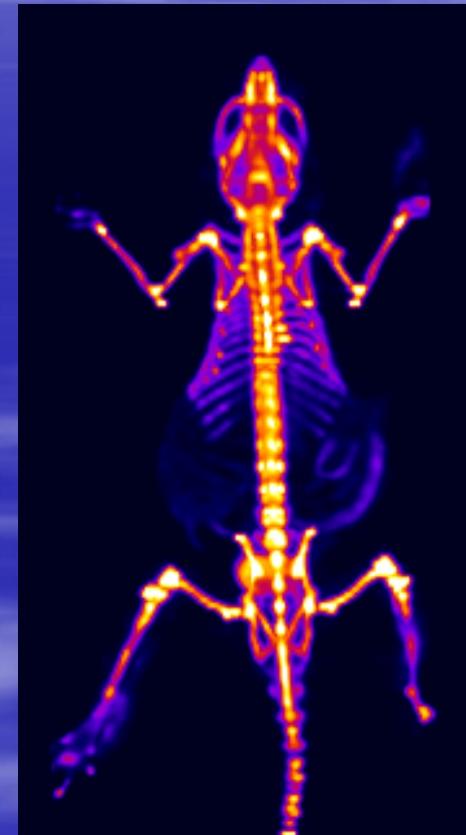
**Tumor
Activity Decrease
Observed
Within Days**

F18-Fluoride Whole Body Mouse

3D-FORE / 2D-FBP
Reconstruction



3D-OSEM Reconstruction
5 iterations, 25 subsets



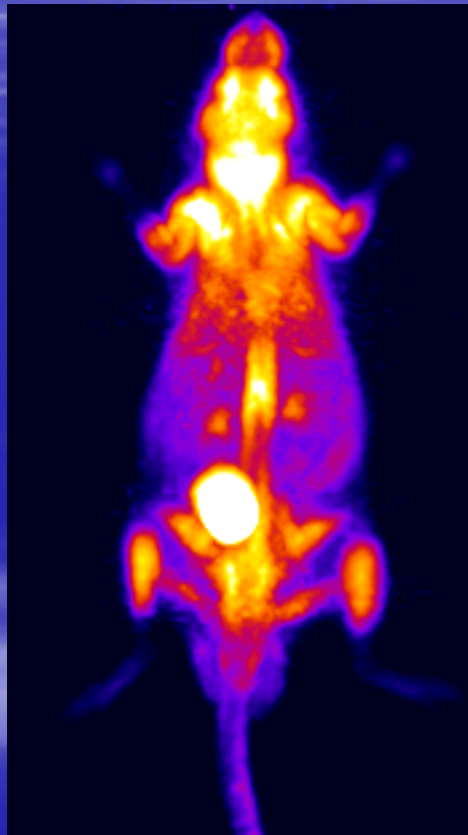
Protocol:

- F-18 Fluoride
- 30 gm mouse
- 45 min uptake
- 3 bed positions
- 4 slice overlap

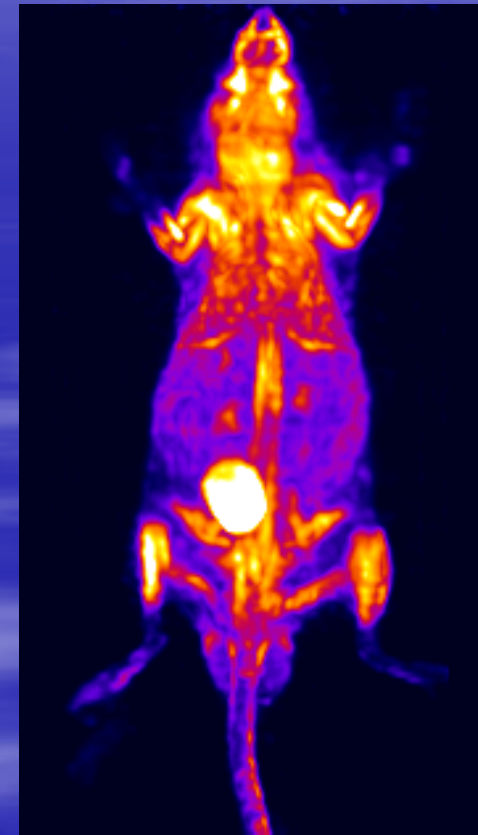
Courtesy M. Pomper – JHMI-Baltimore

F18-FDG Whole Body Mouse

3D-FORE / 2D-FBP
Reconstruction



3D-OSEM Reconstruction
3 iterations, 50 subsets

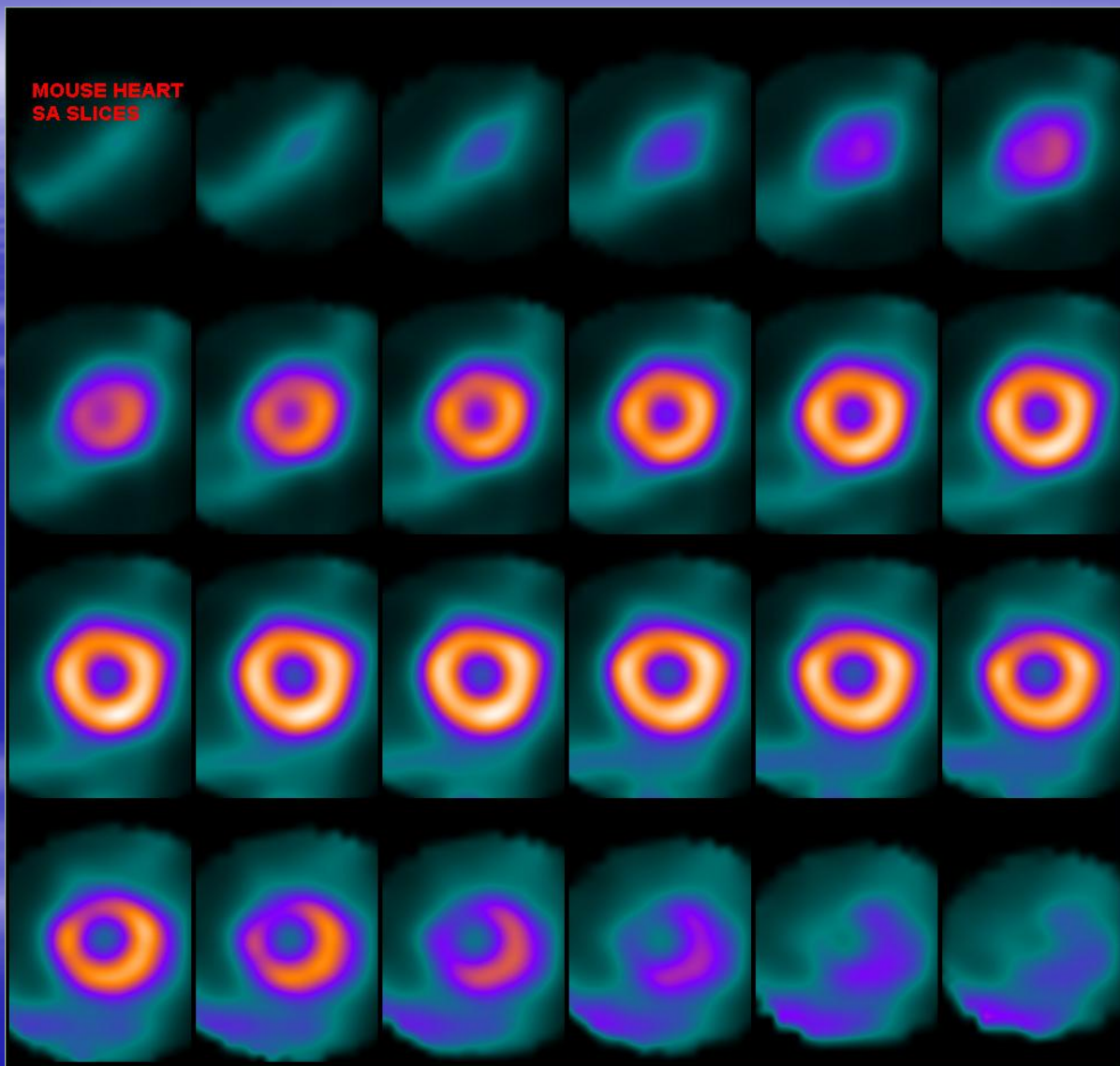


Protocol:

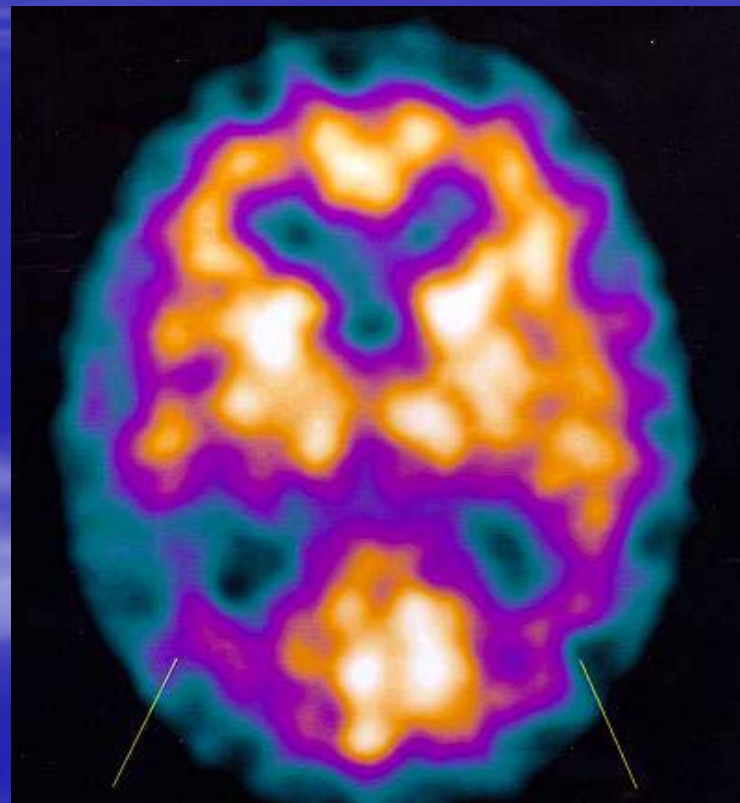
- F-18 FDG
- 20 gm mouse
- 30 min uptake
- 3 bed positions
- 4 slice overlap

Courtesy M. Pomper – JHMI-Baltimore

MOUSE HEART
SA SLICES



DOENÇA DE ALZHEIMER: defeito têmporo-parietal posterior bilateral

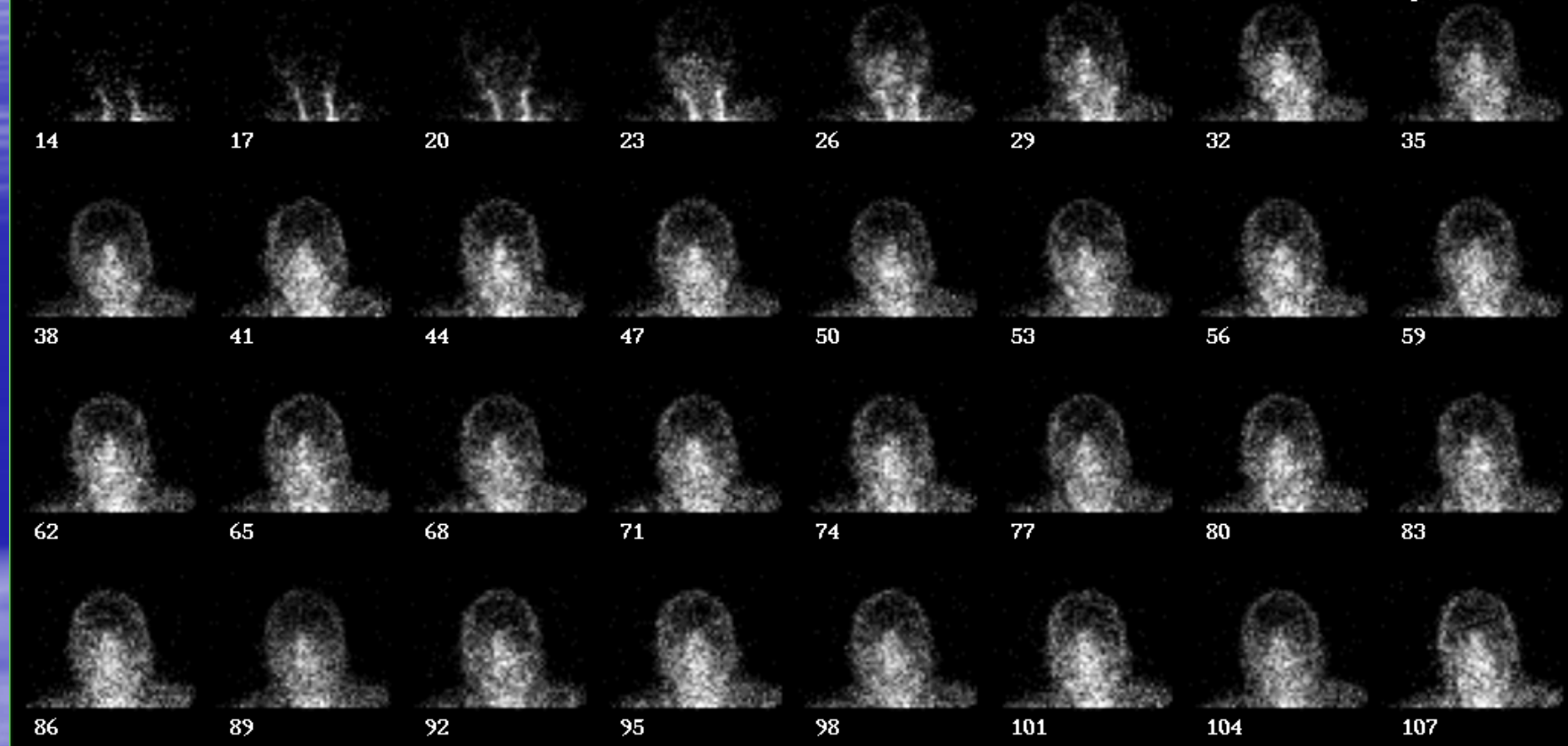


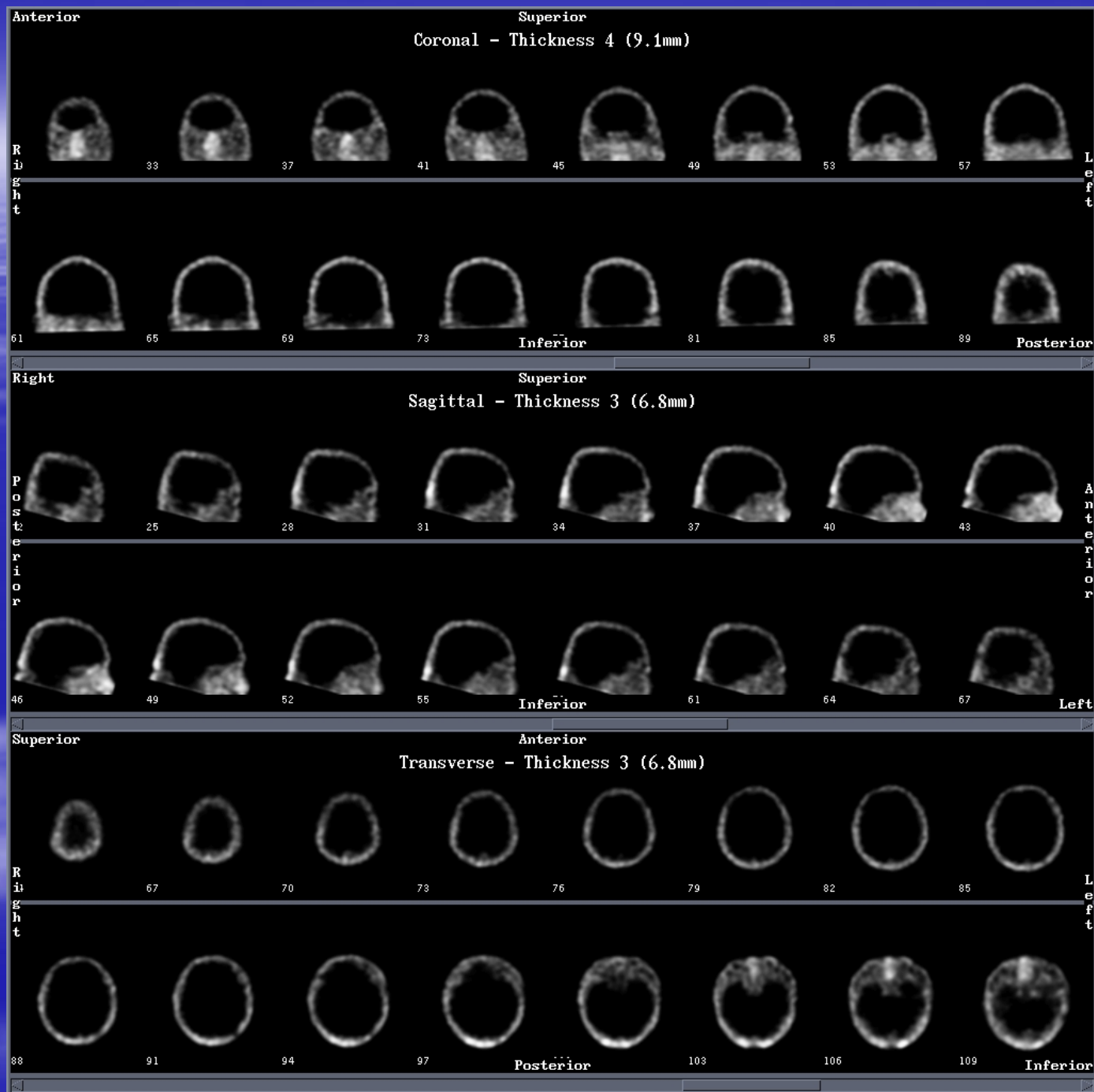
Bilateral Posterior Temporal-Parietal Perfusion Defect (Patt

MORTE CEREBRAL

FLUXO CEREBRAL - AP

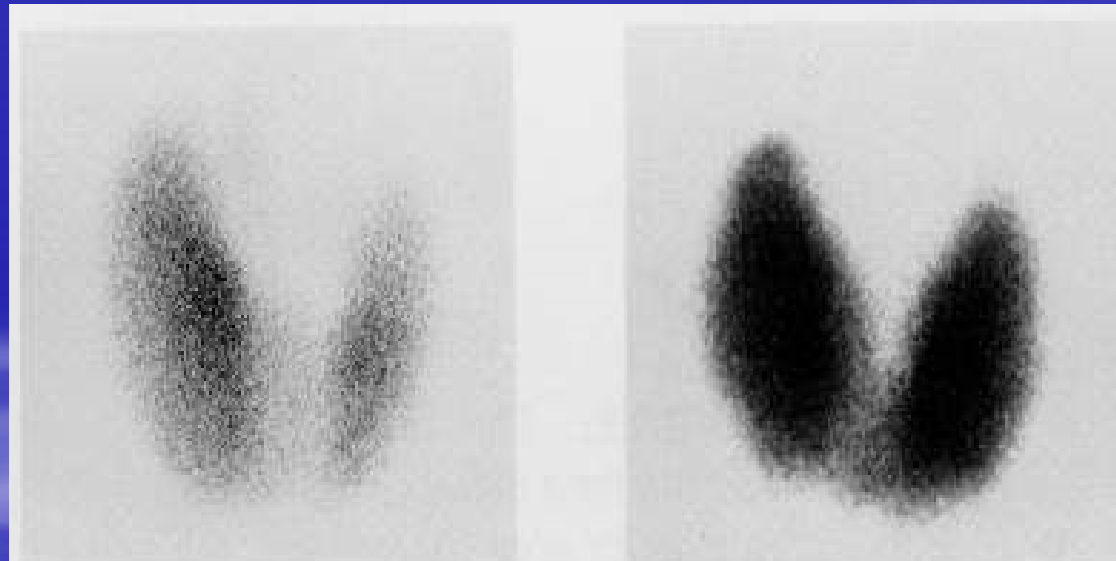
21-Sep-1999 15:53





TIREÓIDE

Doença de Graves



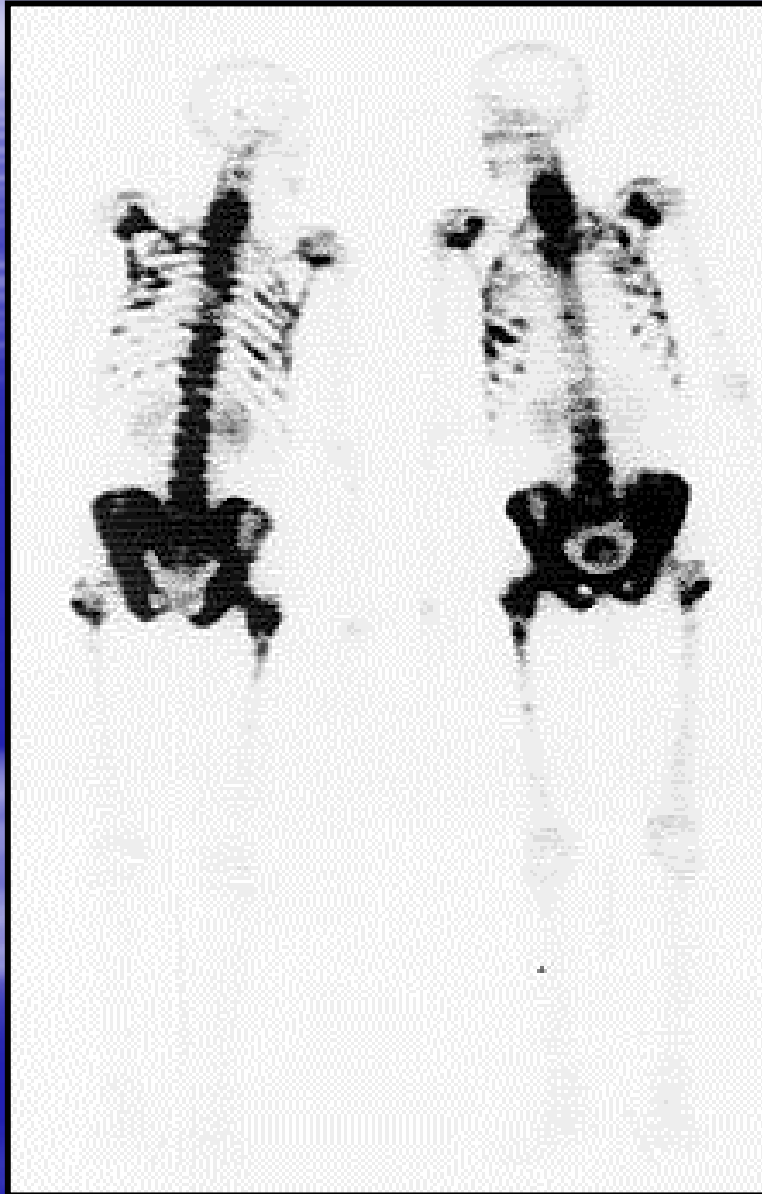
TIREÓIDE

Nódulo único “frio”



- Adenoma folicular

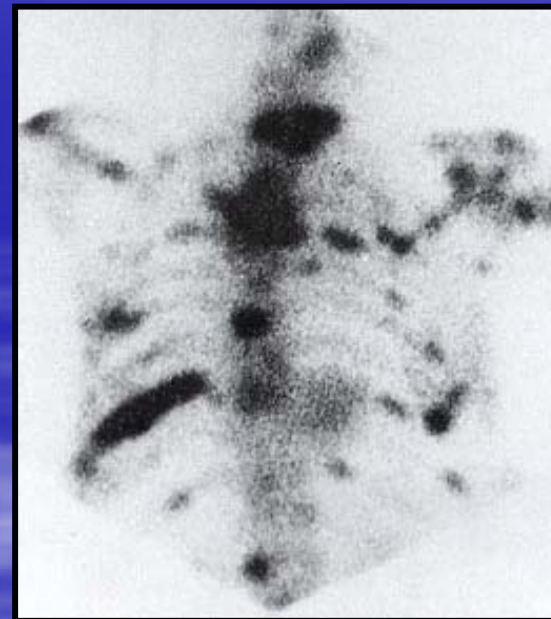
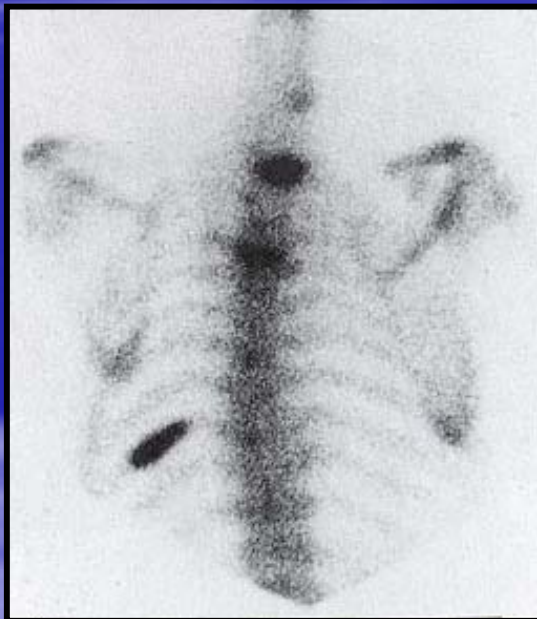
Cintilografia Óssea - Ca Próstata



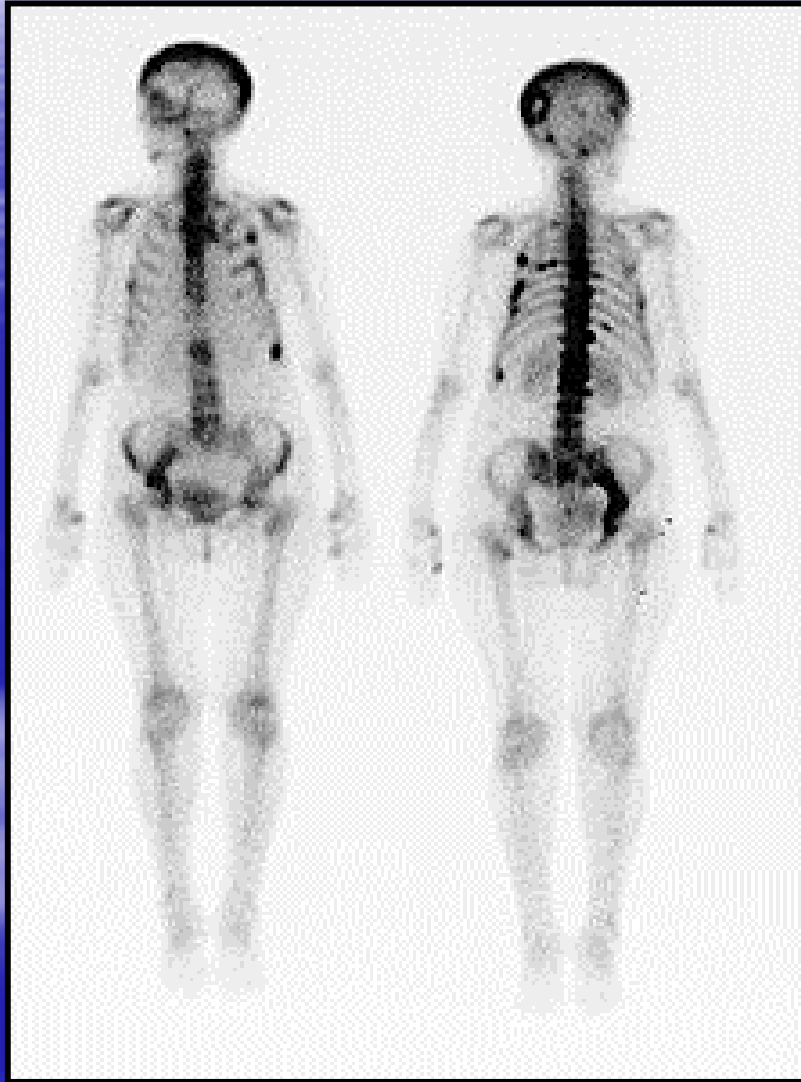
- osso é o local mais frequente de disseminação metastática
 - estadiamento:
 - PSA < 10 dispensável
 - PSA 10 - 20 discutível
 - PSA > 20 rotina
 - estudos seriados:
 - extensão
 - resultado terapêutico
- * terapia hormonal altera PSA

Cintilografia Óssea - Seguimento (progressão sem terapia)

Ca Próstata (3 meses)

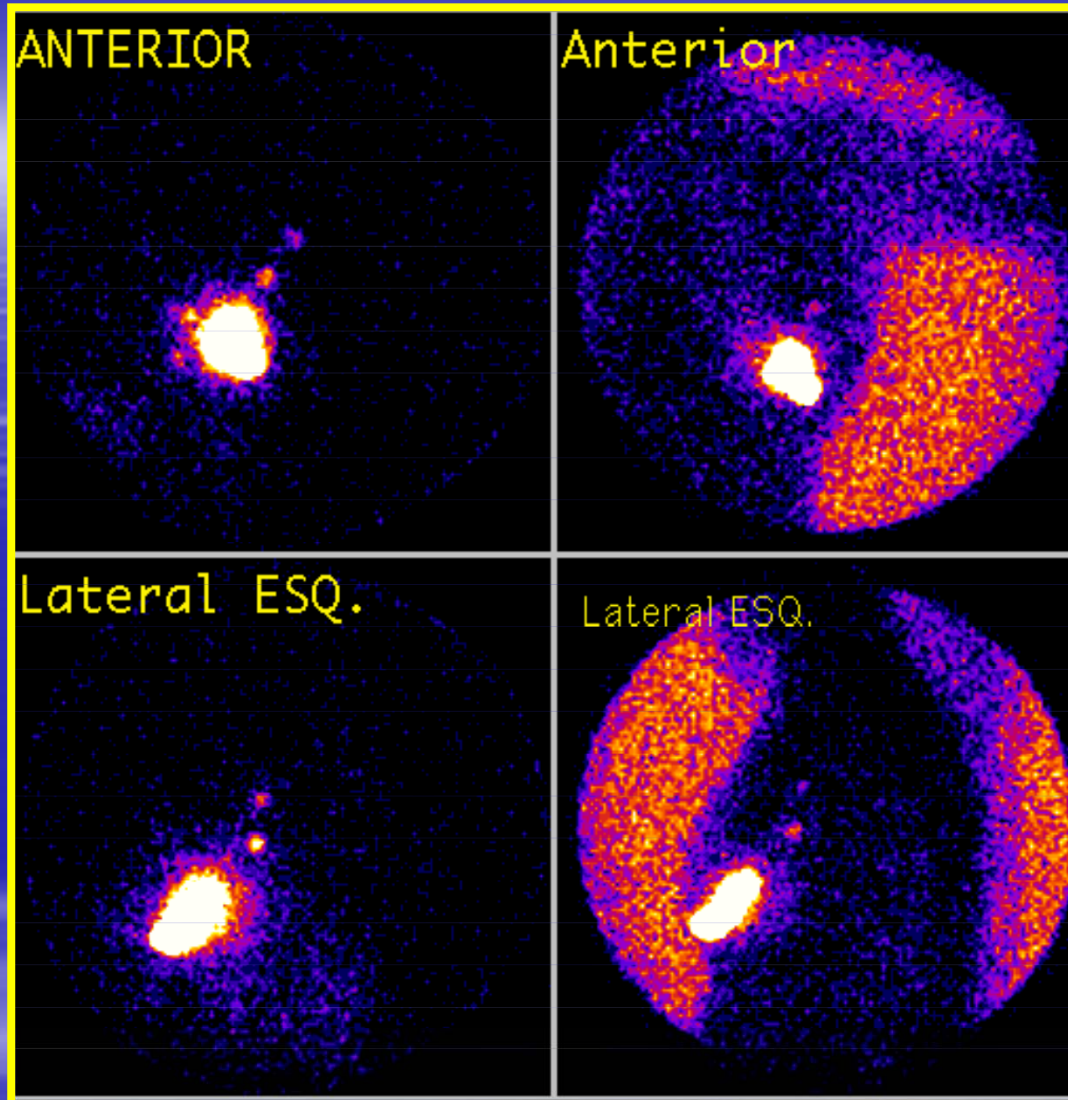


Cintilografia Óssea - Ca Mama



- metástases ósseas frequentes
- estadiamento:
 - discutível nos estadios I e II ($< 10\%$)
 - estadios III e IV
- avaliação de sintomas relacionados (dor)
- avaliação de alterações em RX
- estudo basal (discutível)
- estudos seriados (seguimento)
- avaliação resposta terapêutica

Projeção
anterior da
mama
esquerda



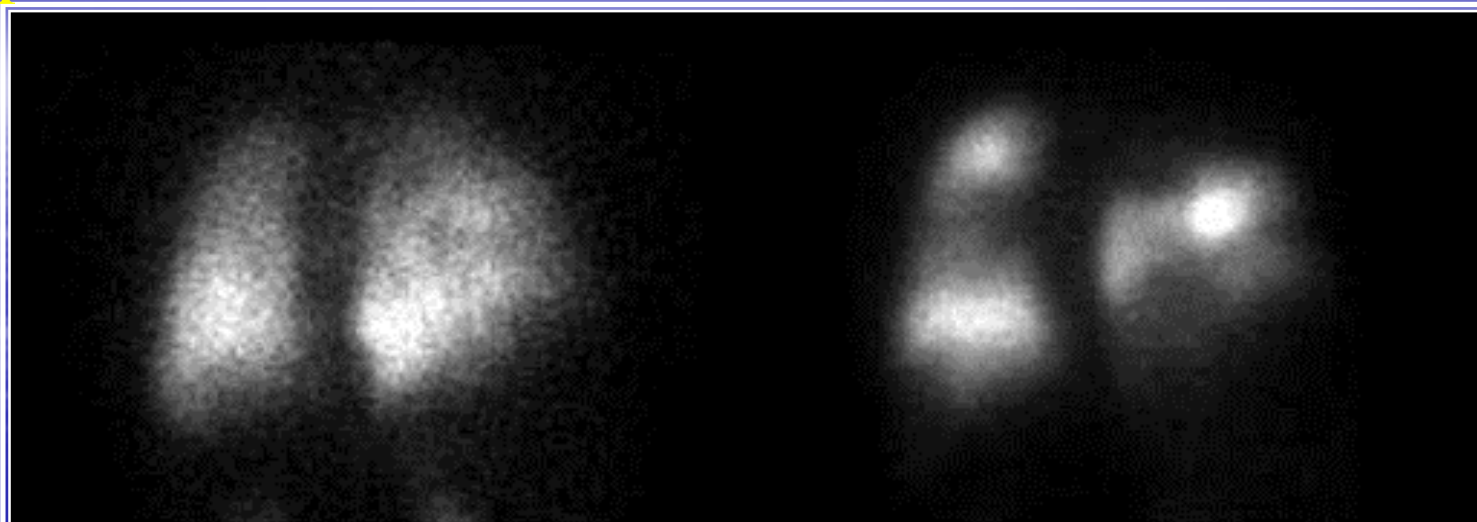
Projeção
anterior com
transmissão

Projeção
lateral
esquerda

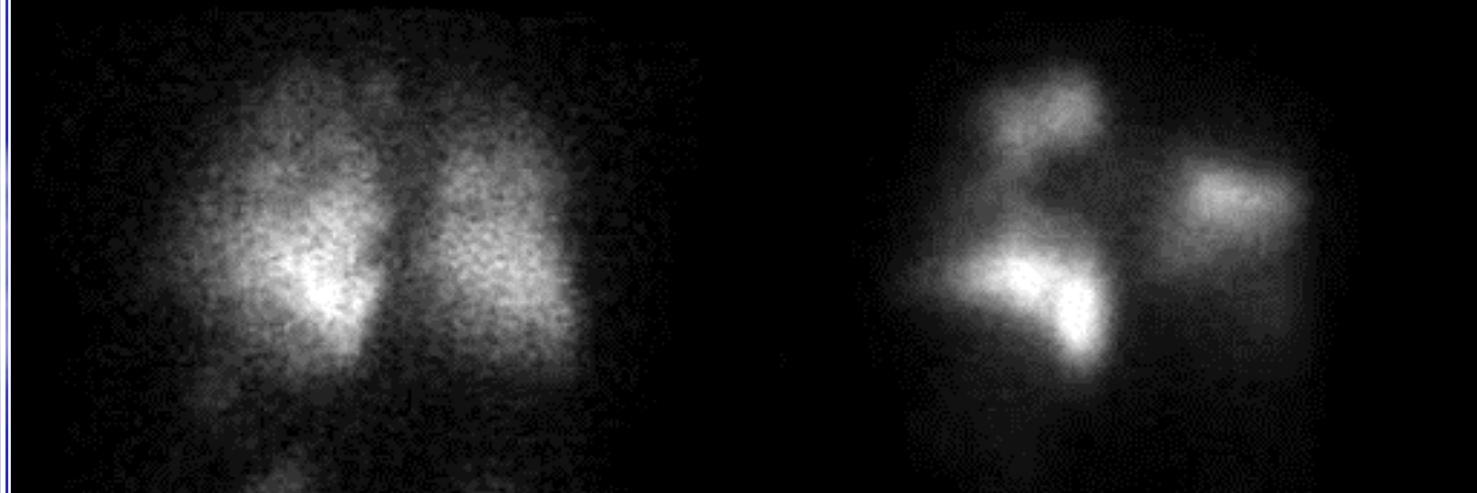
Projeção lateral
esquerda com
transmissão

Neste caso, evidencia-se em imagens tardias, após injeção de dextran-70 no quadrante superior e externo da mama esquerda a presença de áreas focais hipercaptantes na topografia das cadeias axilar e mamária interna.

TEP

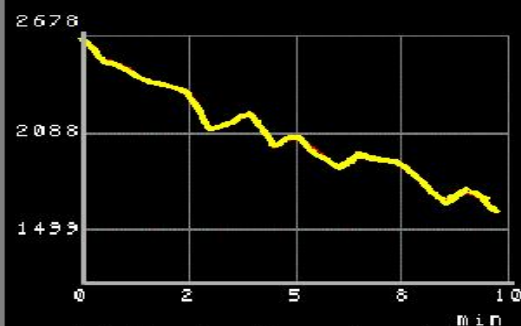
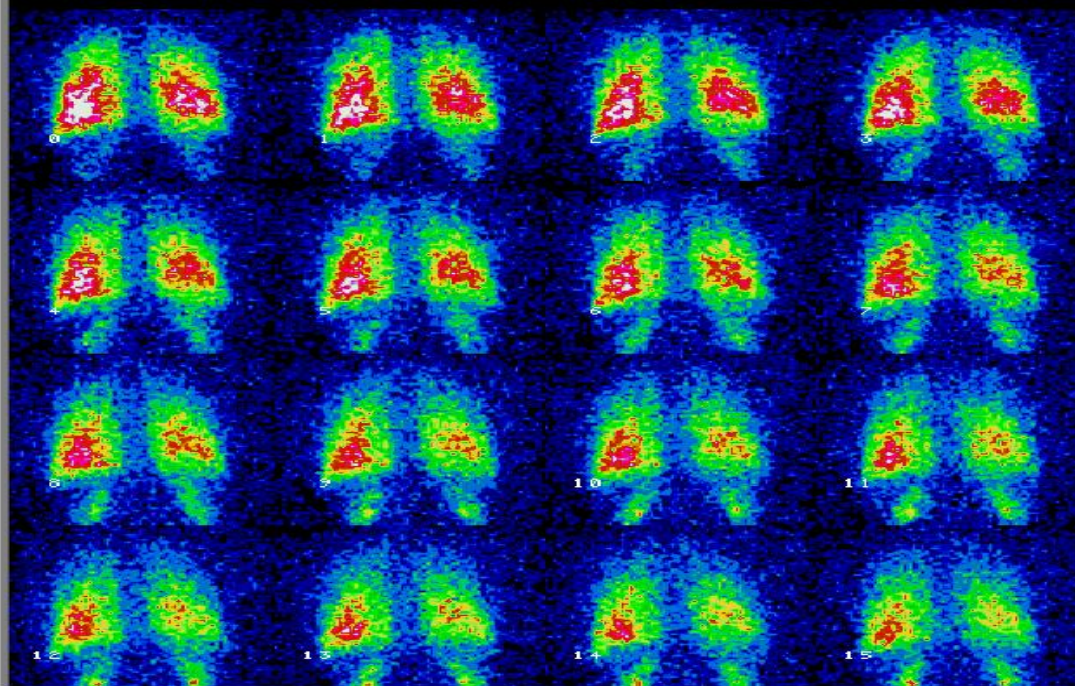


INALACAO OPD30-Tc 99RP00 PERFUSAO OPD-Tc 99RP0030



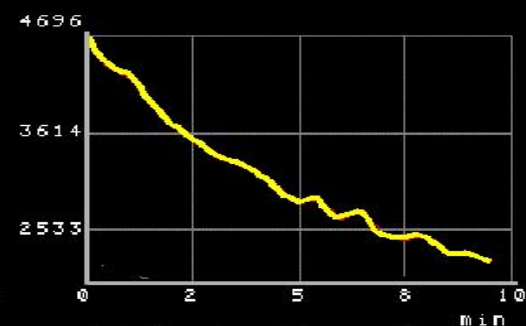
INALACAO OPE30-Tc 99LP00 PERFUSAO OPE-Tc 99LP0030

Clearance de DTPA-99mTc



Pulmón izquierdo

T 1/2 = 14 min



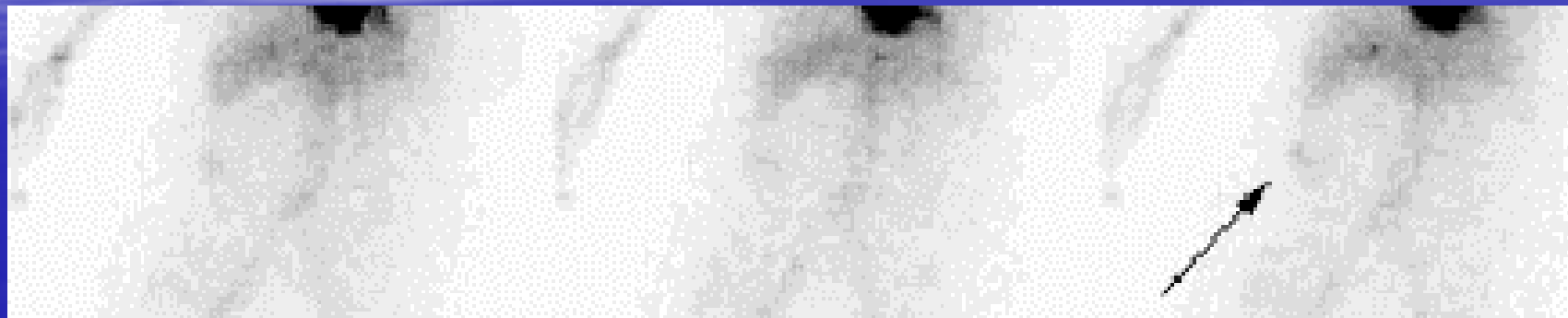
Pulmón Derecho

T 1/2 = 8 min

T 1/2 Total = 10 min

PESQUISA DE SANGRAMENTO INTESTINAL

HEMÁCIAS MARCADAS- Tc99m



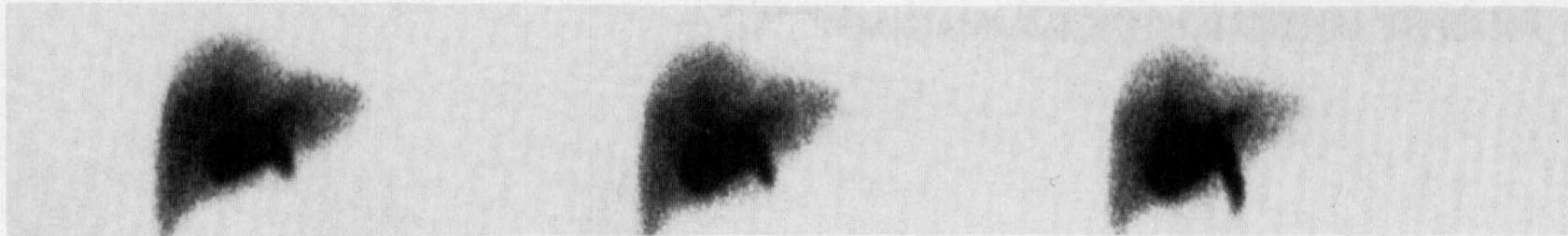
a.



b.

DISIDA

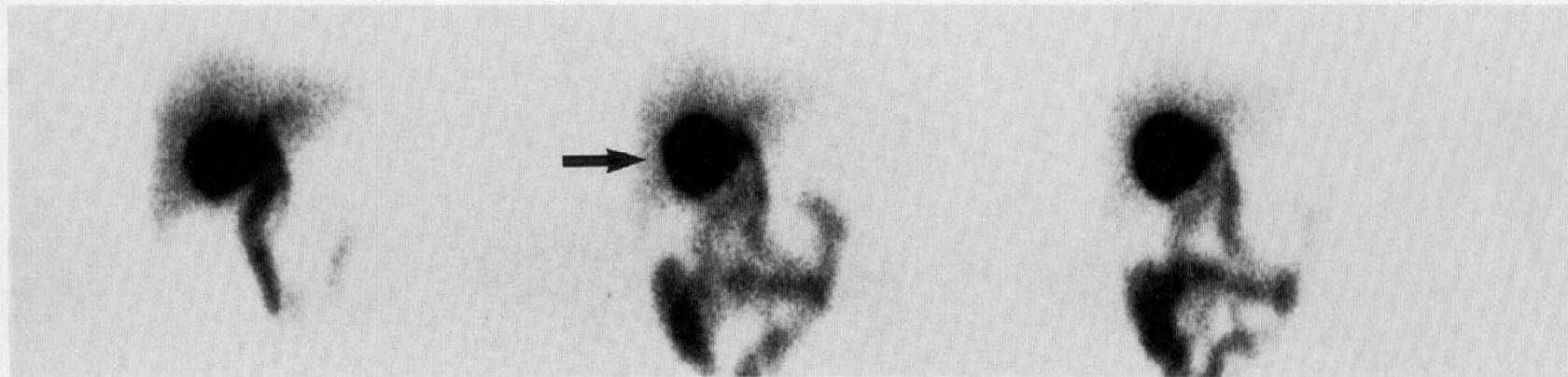
EXAME NORMAL



20 min

25 min

30 min



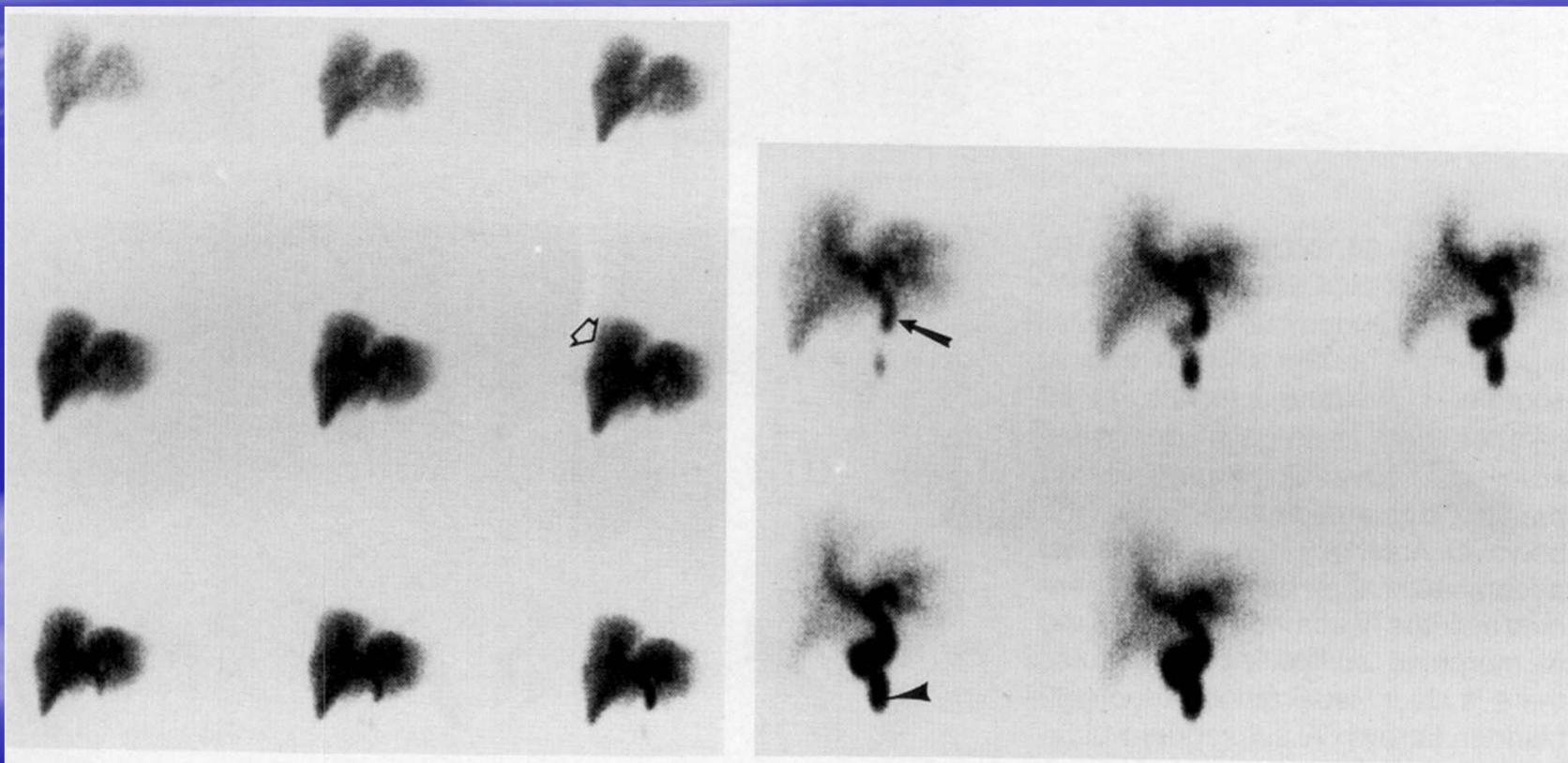
40 min

50 min

60 min

DISIDA

COLECISTITE AGUDA



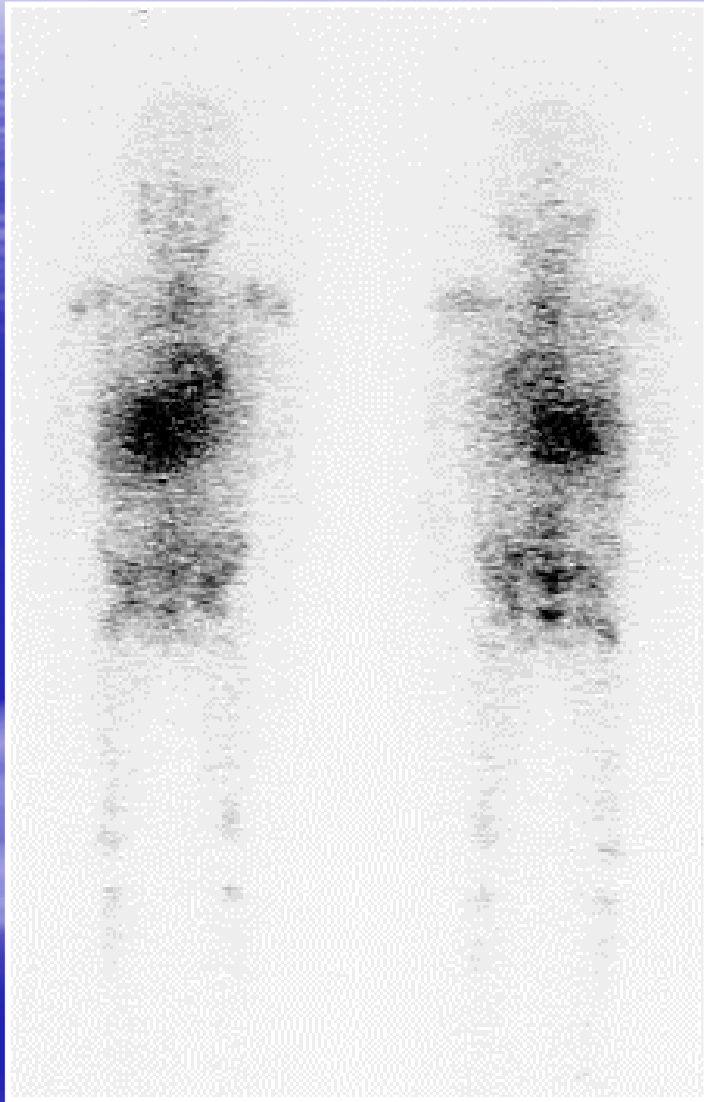
CINTILOGRAFIA RENAL ESTÁTICA COM DMSA-Tc99m



**PIELONEFRITE
CRÔNICA**

**Envolvimento
difuso do rim D**

Neuroblastoma - ^{131}I -MIBG



- Tumor sólido extracraniano mais comum na infância
- Sítios metastáticos: linfonodos regionais, fígado, osso e medula óssea
- MIBG: sensível para lesões esqueléticas e extra-esqueléticas

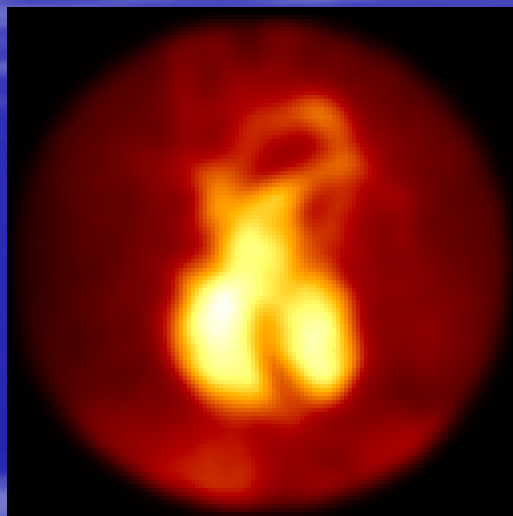
masculino, 52 anos - Linfoma de Hodgkin (esclerose nodular tipo II)

Tratamento quimioterápico:

A (Adriamicina) B (Bleomicina) V (Vimblastina) D (Dacarbazim)

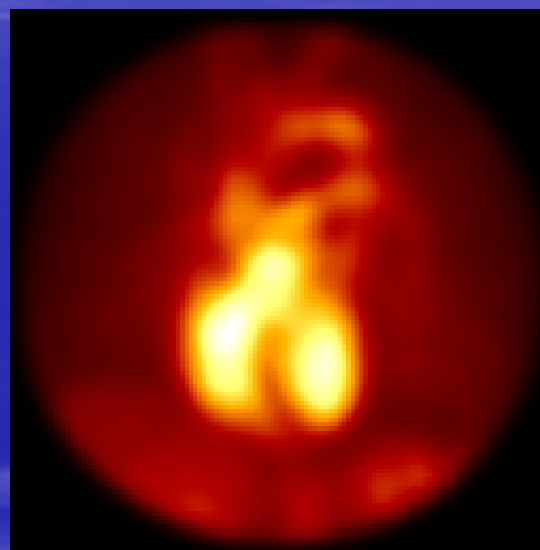
Pré - QT

FEVE =
52 %



Após
3º Ciclo QT

FEVE =
40 %



Interrompido QT

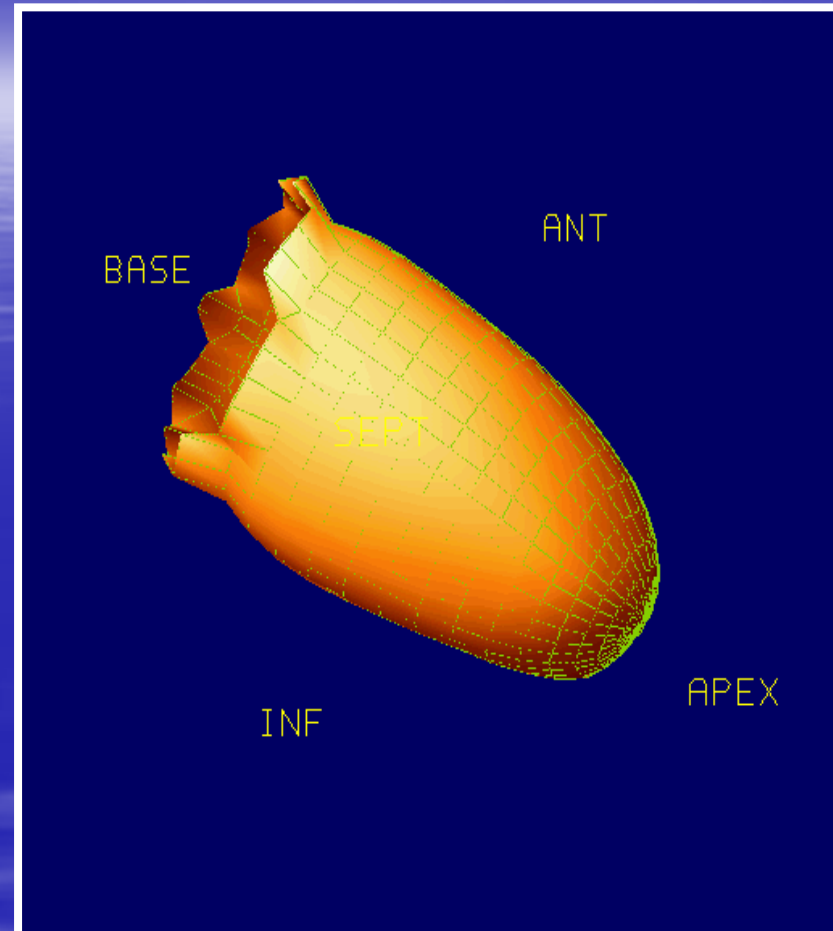
Substituído por C-MOPP:

Ciclofosfamida, Mecloretamina, Vincristina, Procarbazina,
Prednisona

GATED SPECT

Quantitativo

- Motilidade miocárdica (global e segmentar)
- Espessamento de parede
- Volumes sistólico e diastólico
- Fração de ejeção de VE



FEVE= 54 %

PERFUSÃO MIOCÁRDICA -SPECT-

Clinica

Informação

DAC- Suspeita

Diagnóstico para pacientes média probabilidade

Prognóstico- Especialmente qdo alta probab.

Pós IAM/ Angina instável

Avaliação de risco

Baixa função de VE

Miocárdio “stunned” ou hibernante

Pós CAT

Tratamento clínico X revascularização

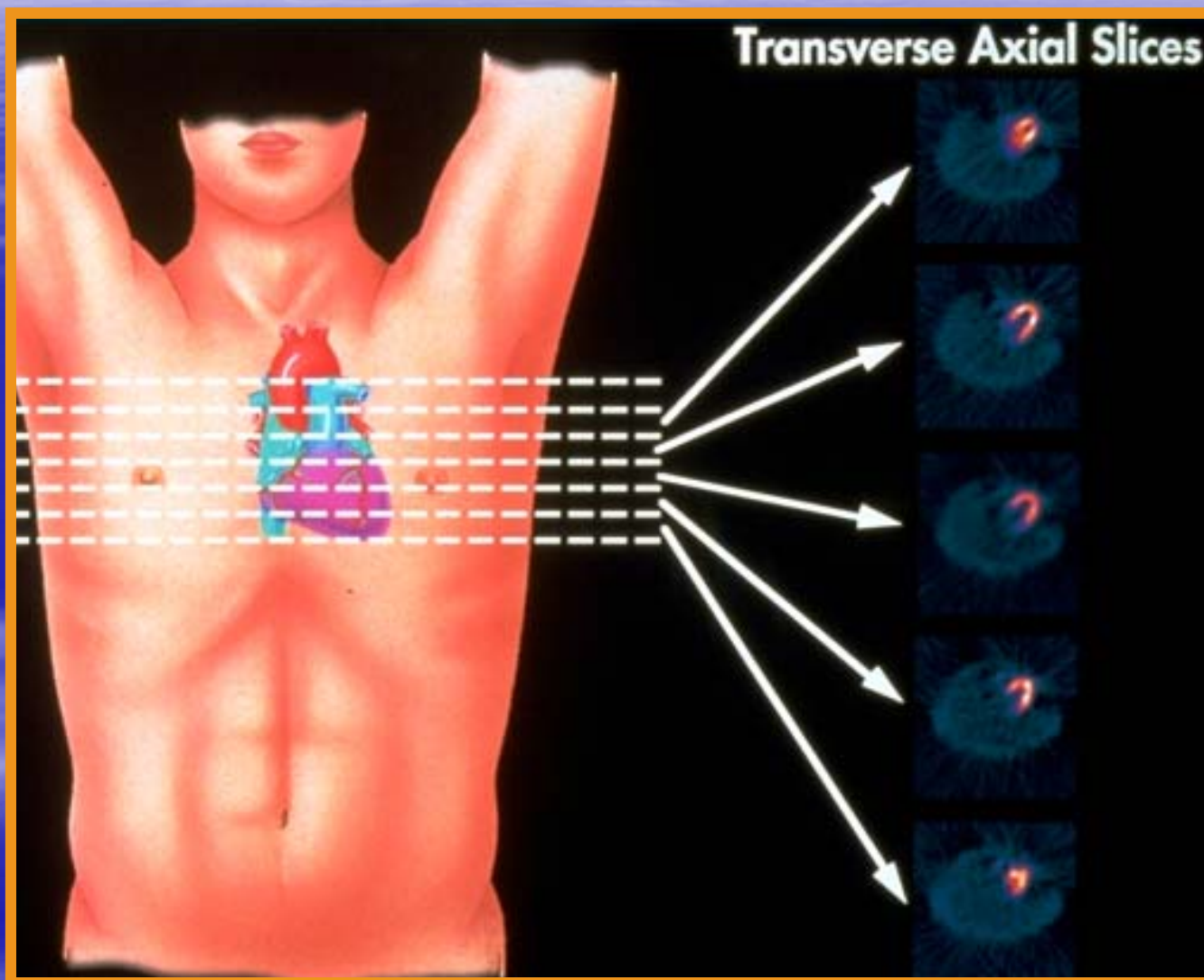
Cirurgia não cardíaca

Avaliação de risco

Pós revascularização

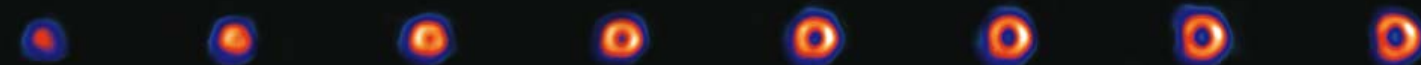
Deteção de reestenose ou oclusão de ponte

RECONSTRUÇÃO



InCor

HC



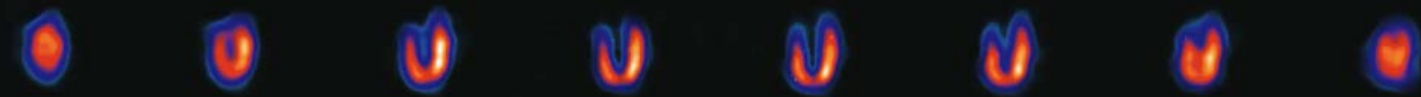
ESTRESSE - EIXO MENOR



REPOUSO - EIXO MENOR



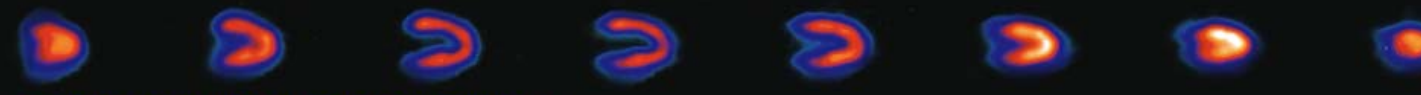
ESTRESSE - EIXO LONGO HORIZONTAL



REPOUSO - EIXO LONGO HORIZONTAL



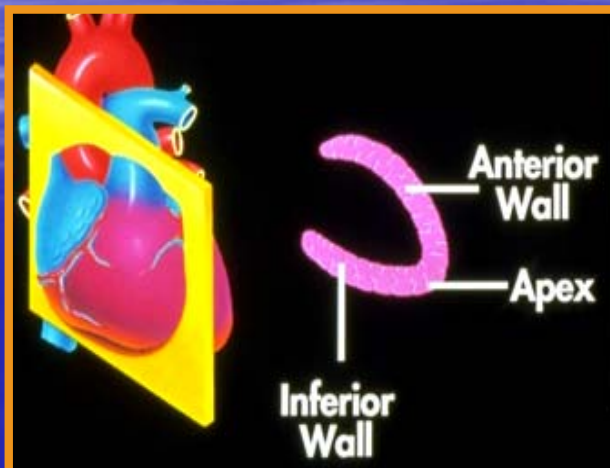
ESTRESSE - EIXO LONGO VERTICAL



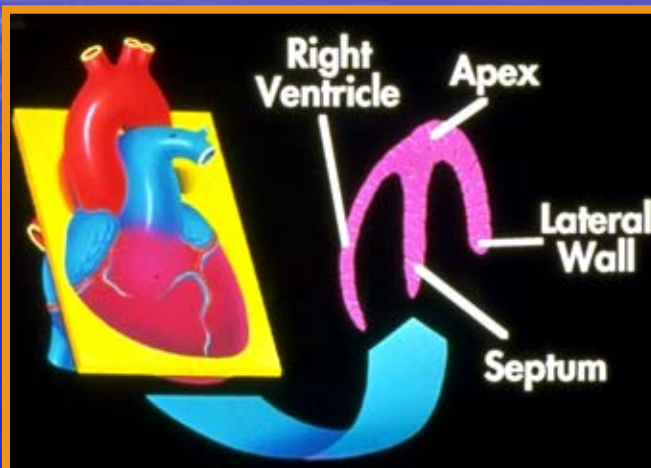
REPOUSO - EIXO LONGO VERTICAL

REORIENTAÇÃO

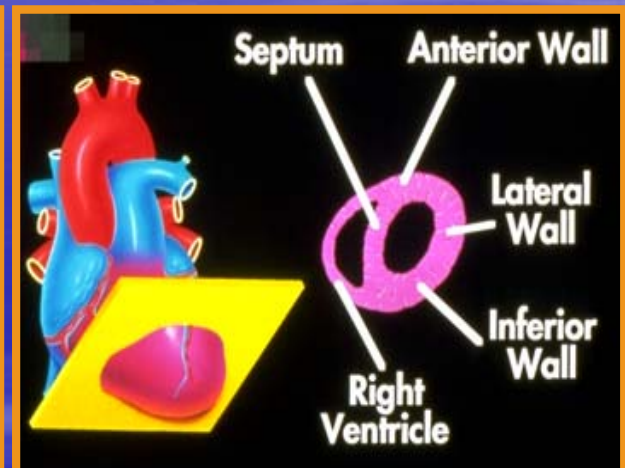
eixo longo vertical



eixo longo horizontal

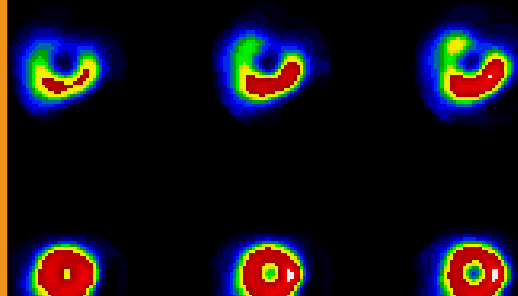
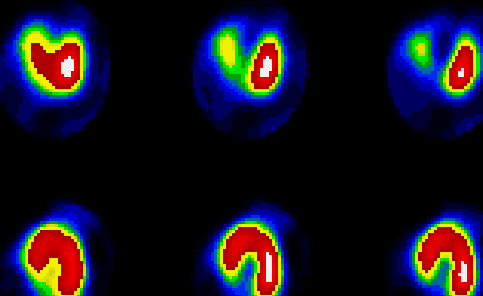
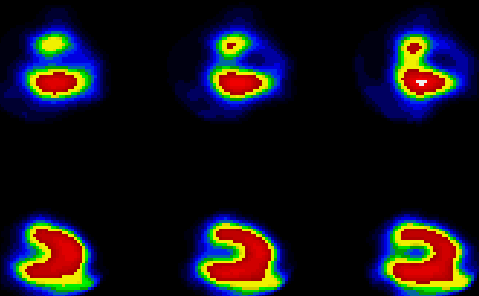


eixo menor



E
X

R
E
P

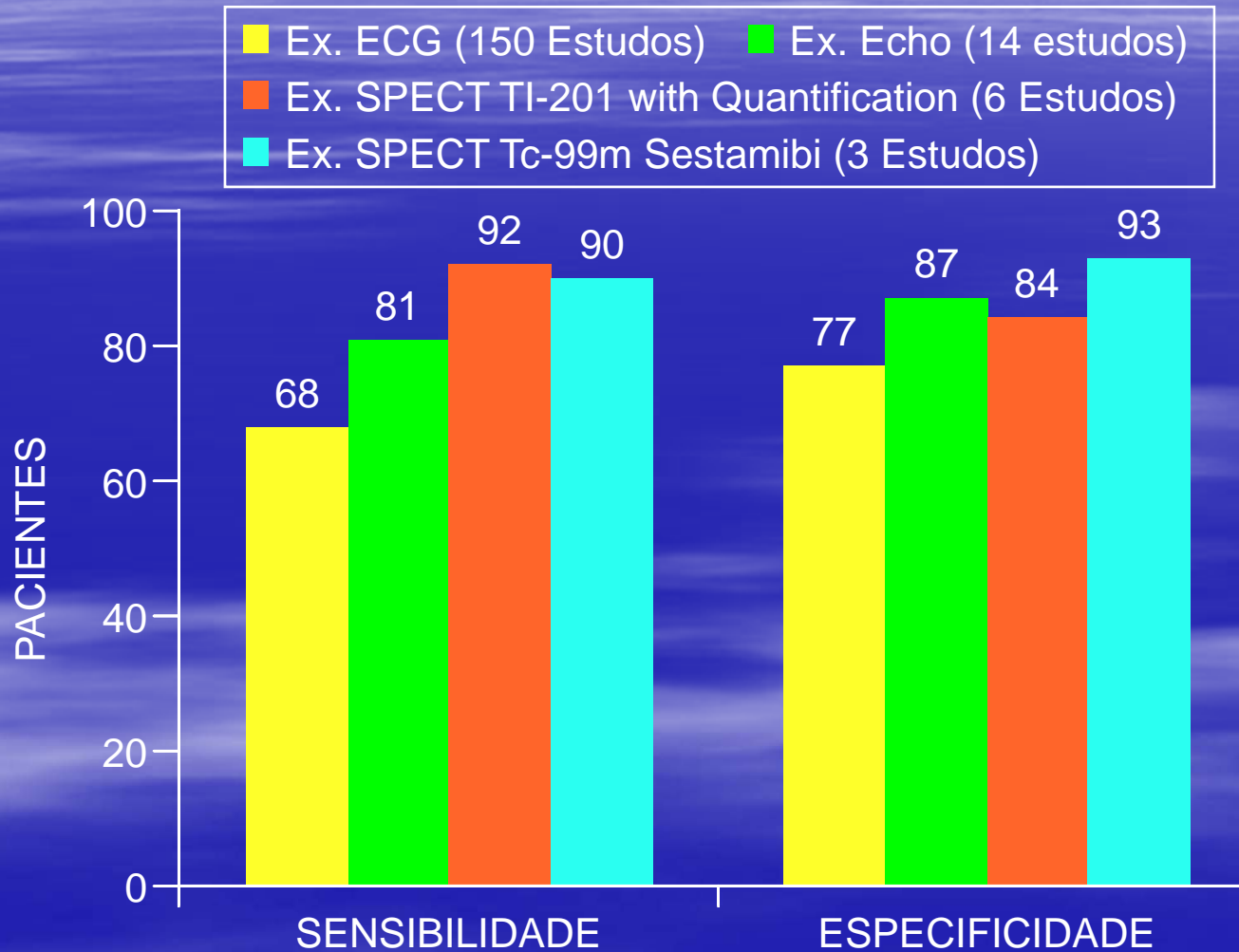


^{99m}Tc MIBI

InCor

HC

SENSIBILIDADE E ESPECIFICIDADE MÉTODOS PARA DETECÇÃO DE DAC



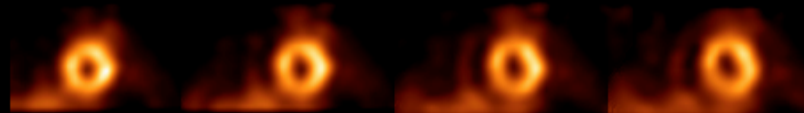
NL

EXERCÍCIO

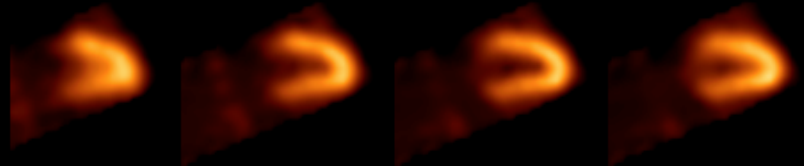


EIXO MENOR

REPOUSO

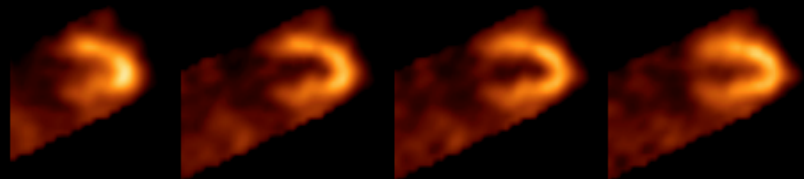


EXERCÍCIO



EIXO LONGO VERTICAL

REPOUSO



EXERCÍCIO

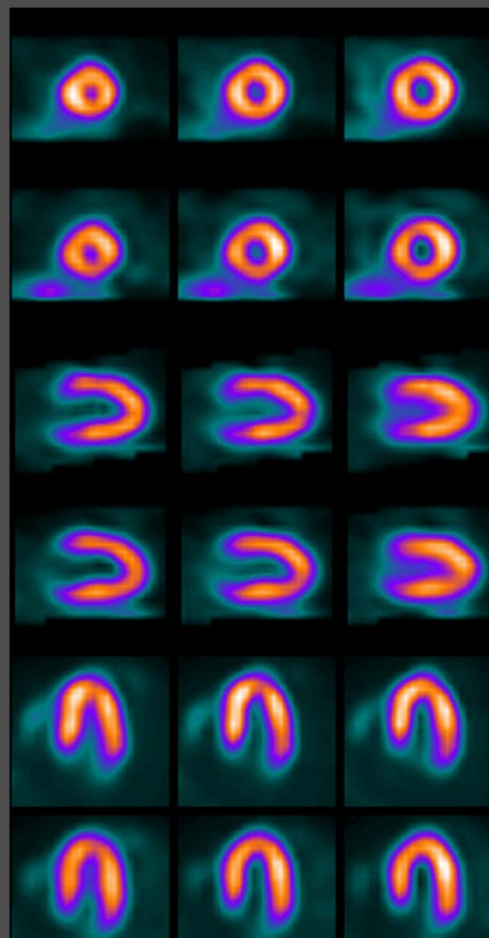


EIXO LONGO HORIZONTAL

REPOUSO

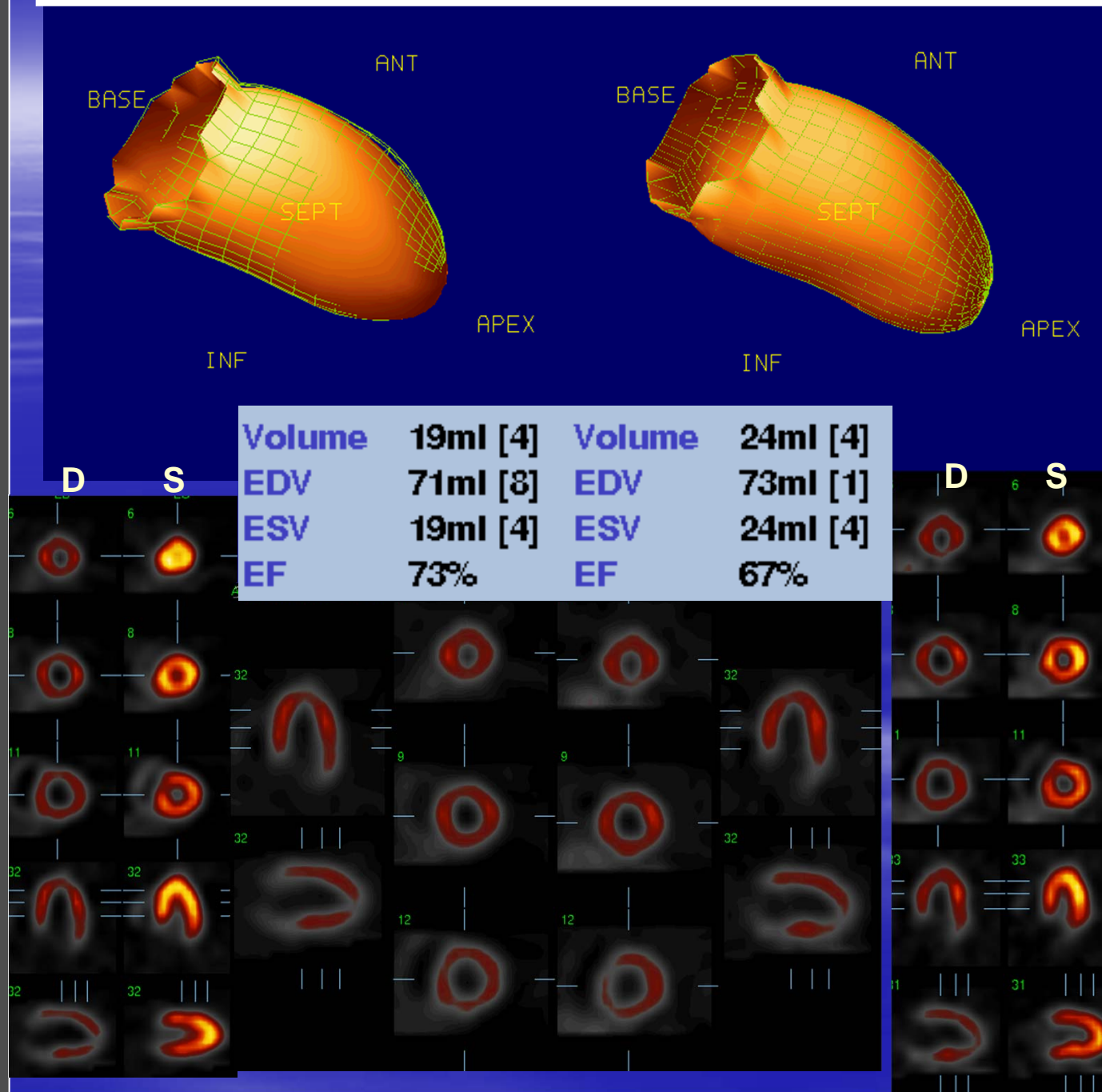


Perfusão miocárdica
 ^{99m}Tc -MIBI
 Exercício- repouso



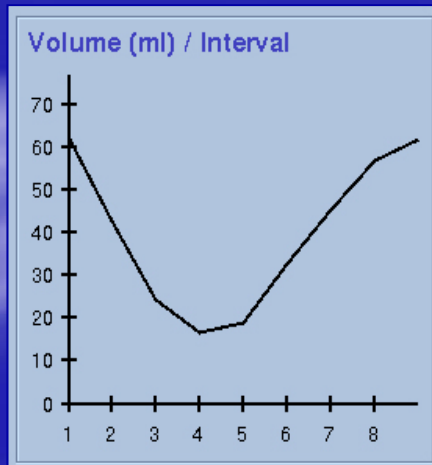
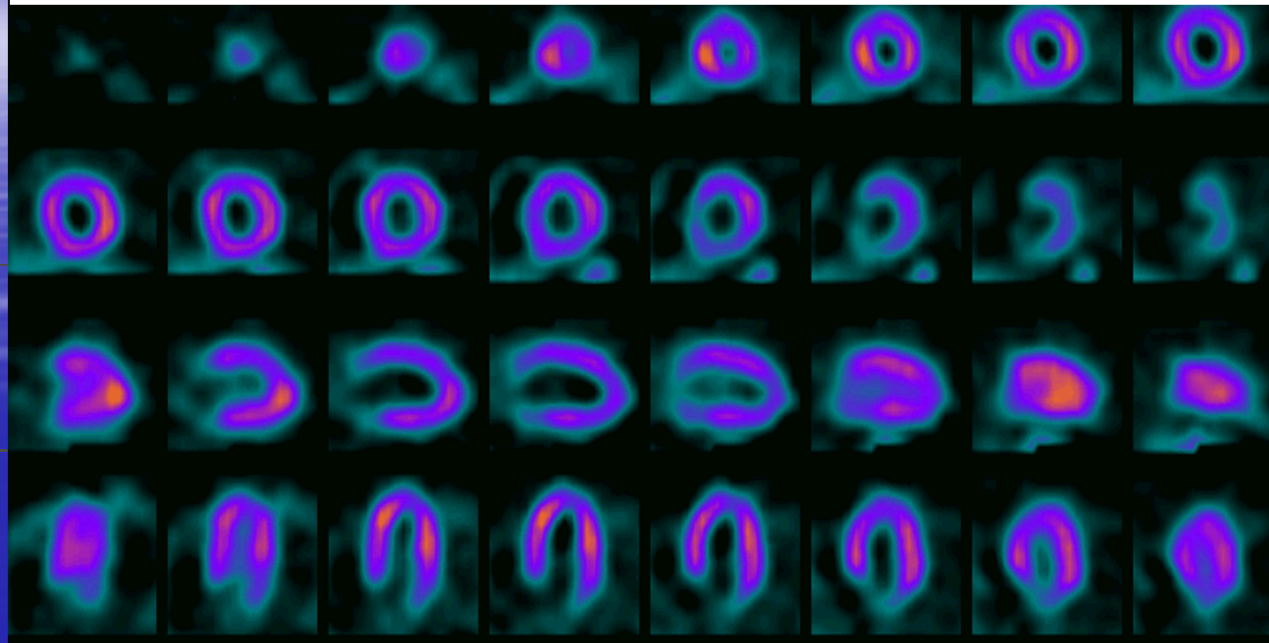
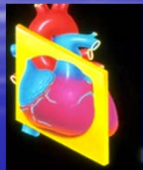
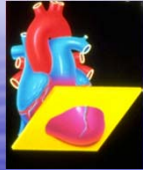
Pós-exercício

Repouso



GSPECT Quantitativo (QGS)

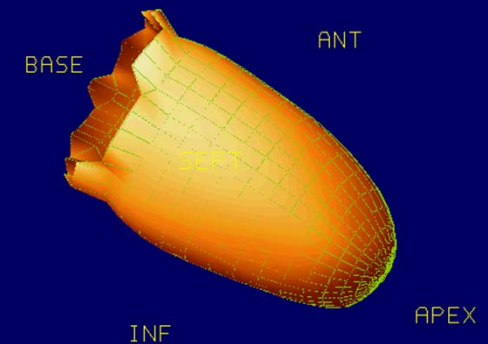
Germano, J Nucl Med, 1995
Germano, J Nucl Med, 1998

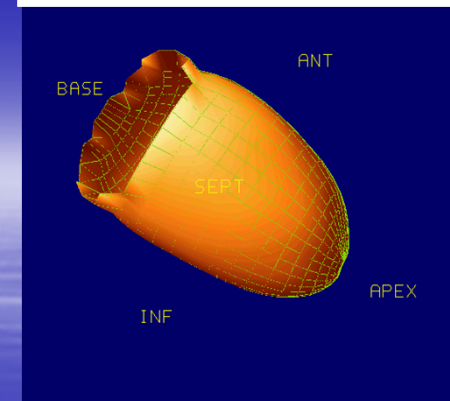
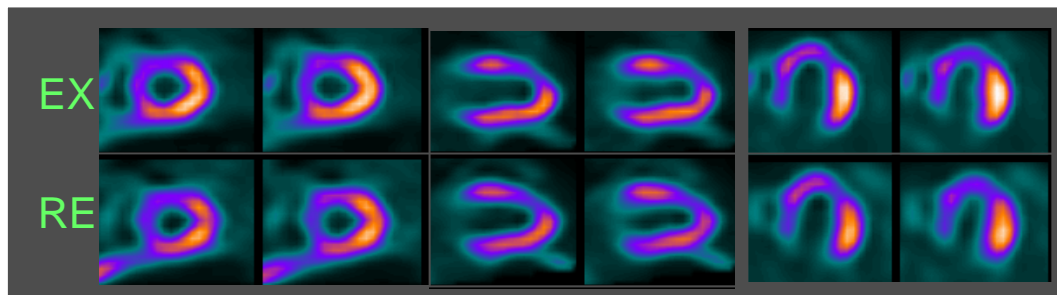


Volume diastólico final (ml)

Volume sistólico final (ml)

$$FE(\%) = \frac{\text{Vol. Diast} - \text{Vol. Sist}}{\text{Vol. Diast}}$$



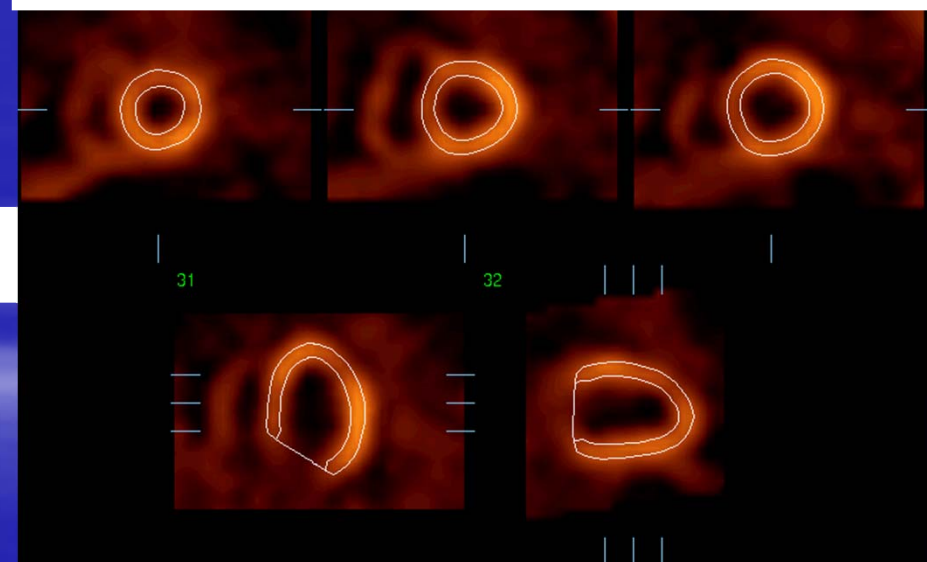


GSPECT Quantitativo (QGS)

Espessamento (% diastóle)
 Δ espessura parede (epic –endo)
 diást e síst (geometria e volume parcial)



Motilidade regional (mm)
 Δ distância (diast – síst) de pto endoc

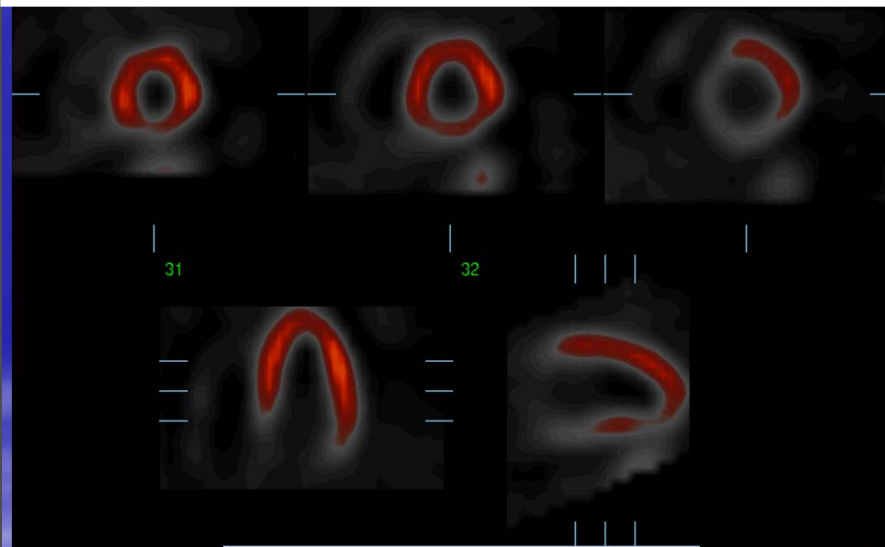
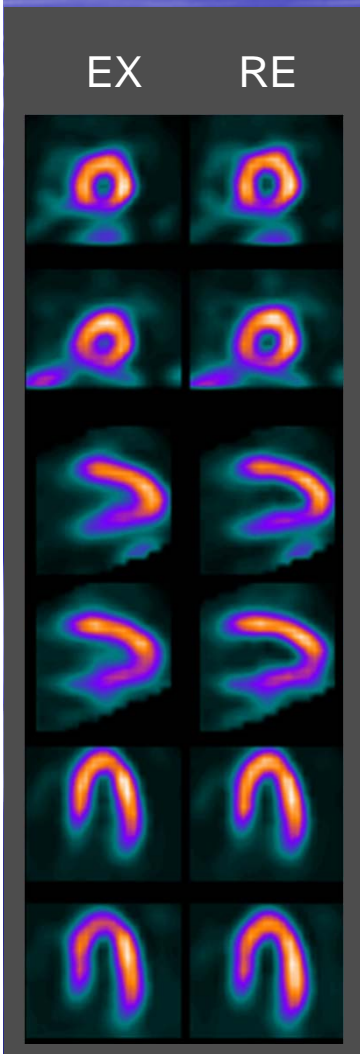


GSPECT Quantitativo \Rightarrow IMPORTÂNCIA ?

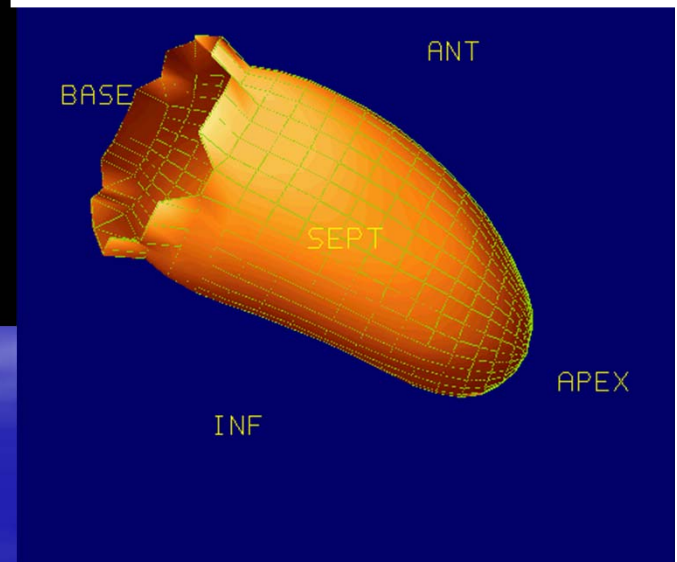
➤ ↑ especificidade por ↓ de artefatos (atenuações)

Especificidade: 84 % \Rightarrow 94 % (DePuey,1995)

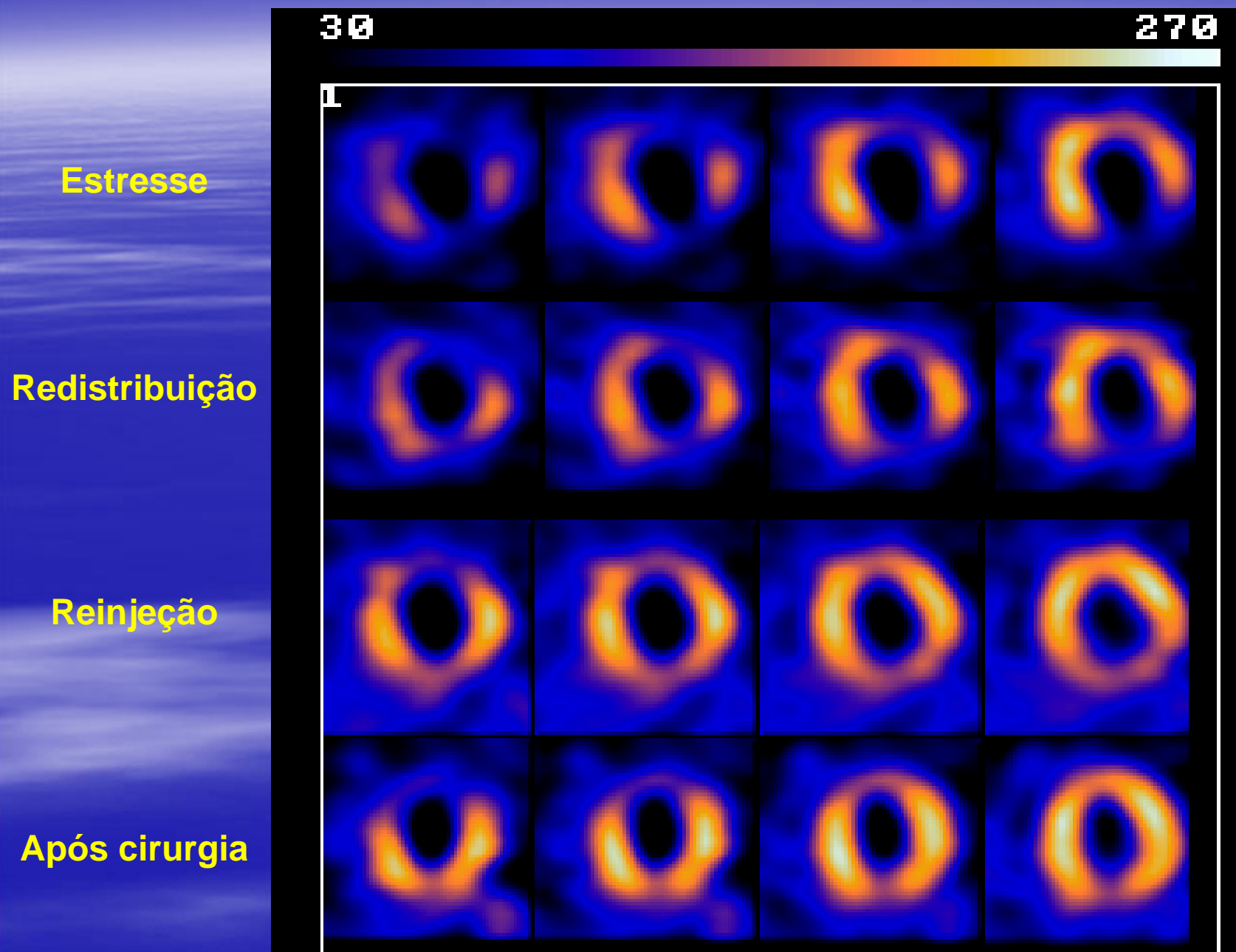
Falso-positivos: 14 % \Rightarrow 03 % (Taillefer,1997)



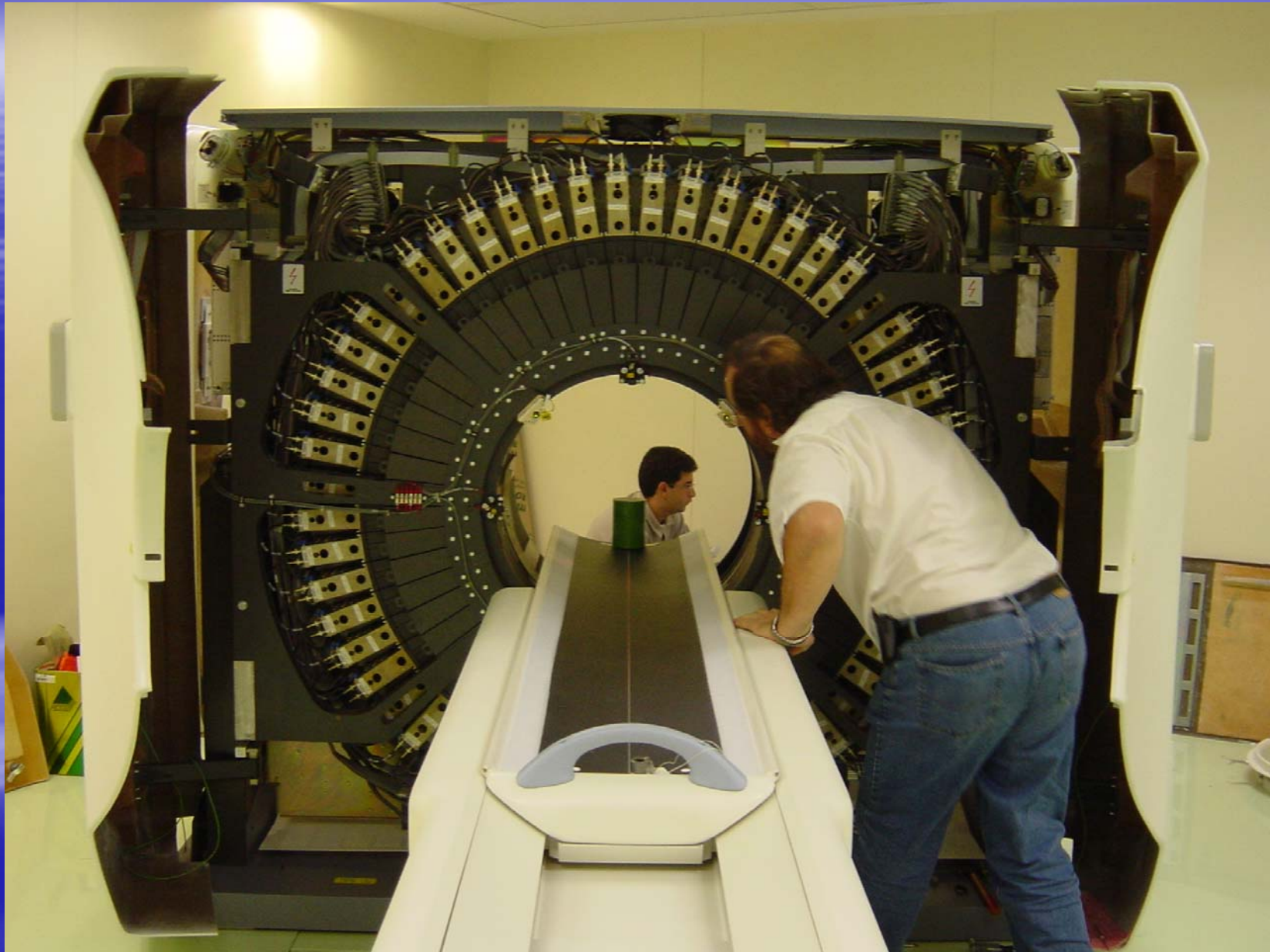
Volume	102ml [1]
EDV	102ml [1]
ESV	37ml [4]
EF	64%



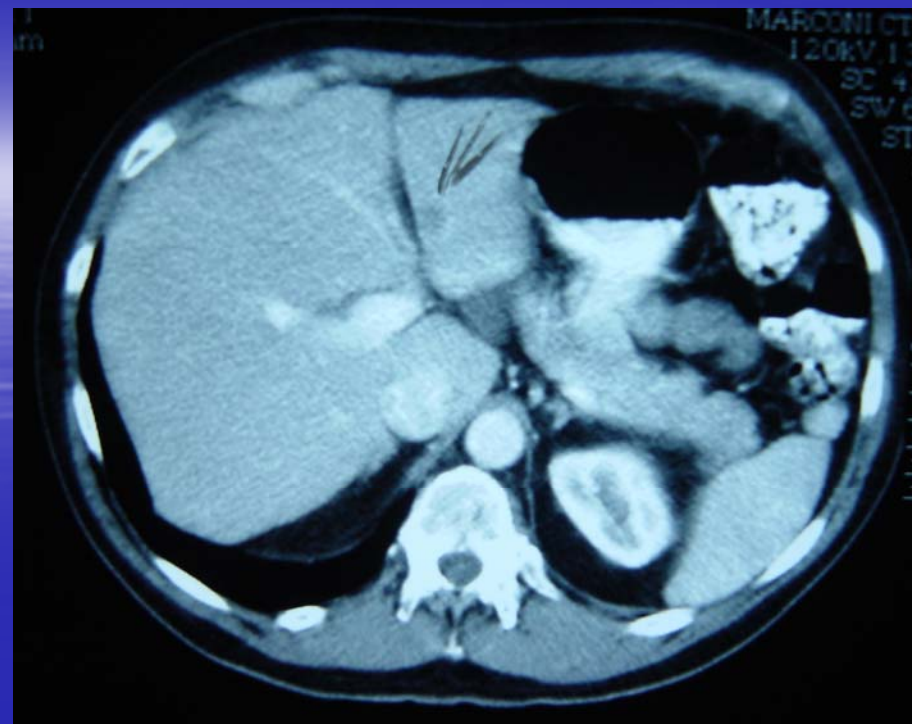
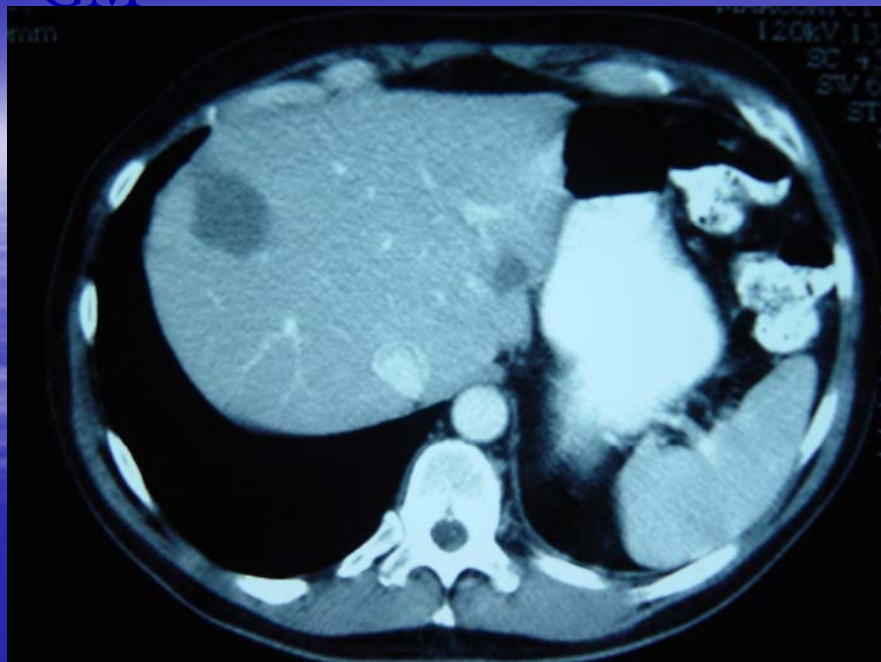
VIABILIDADE MIOCÁRDICA COM TÁLIO-201



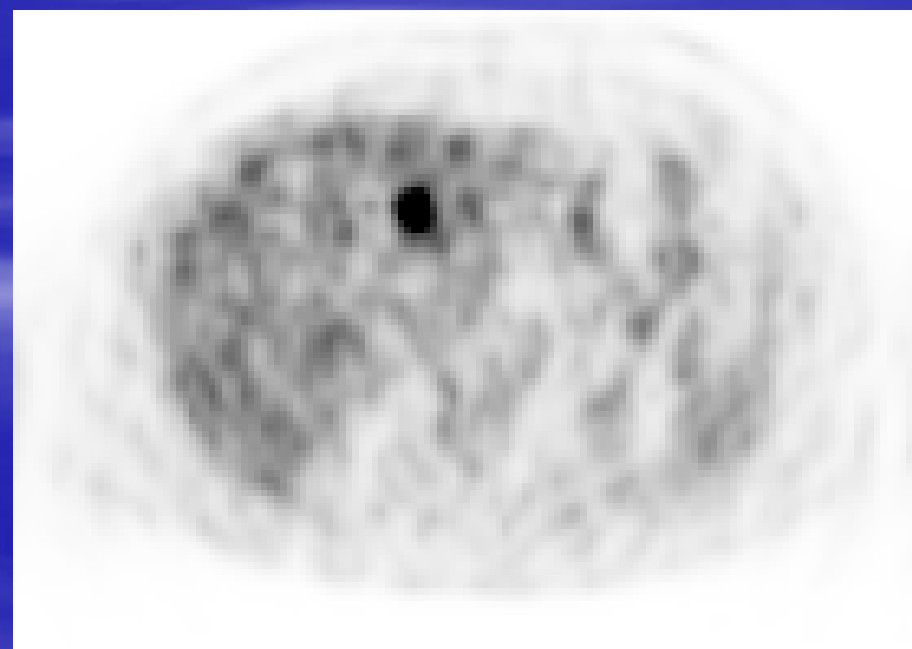
PET DEDICADO



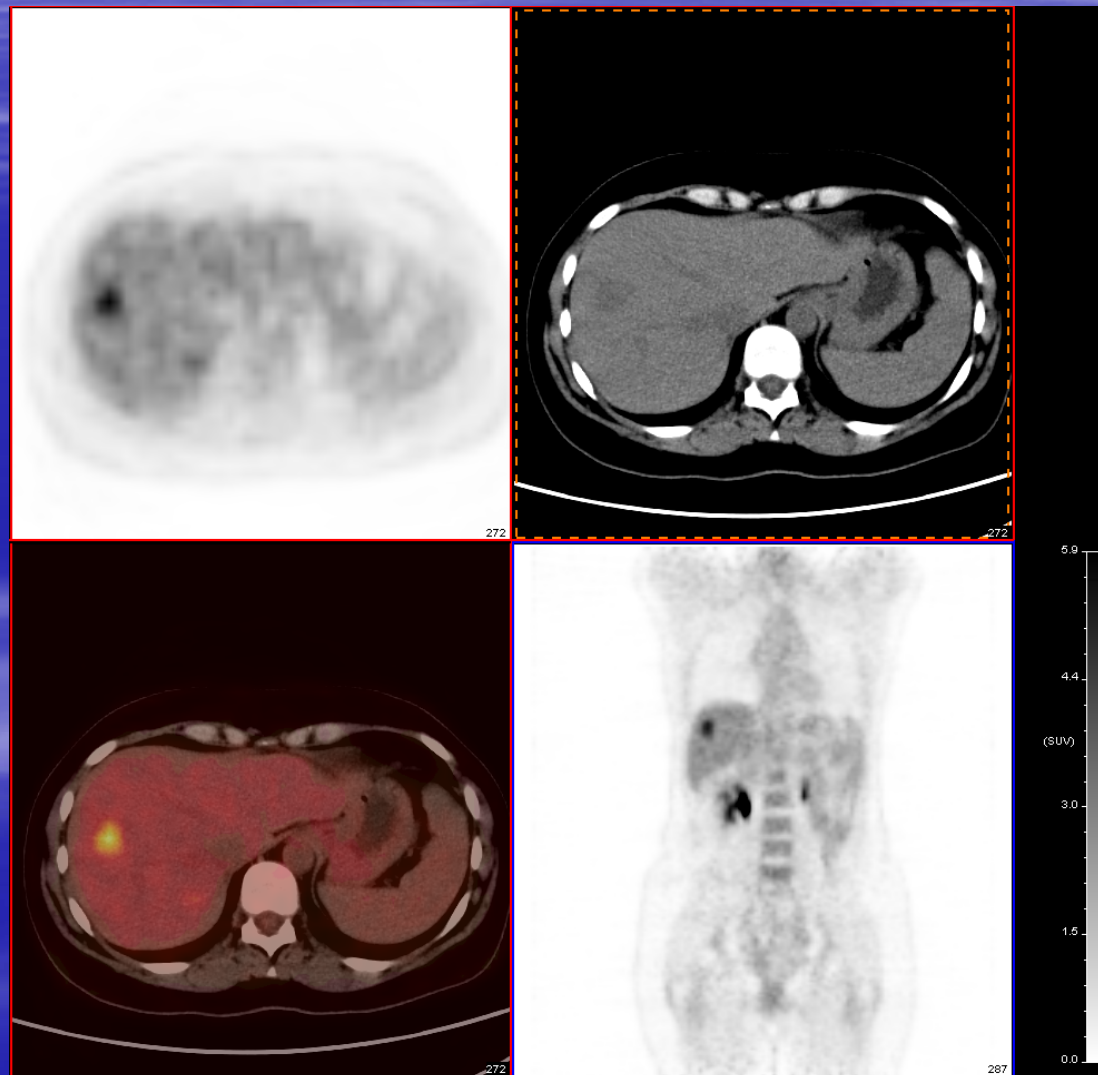
GM



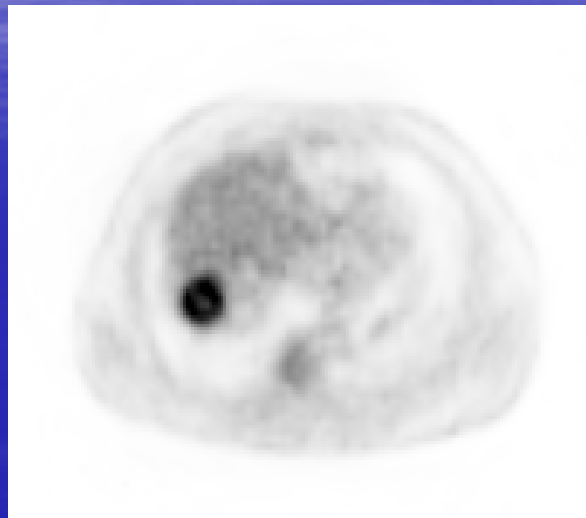
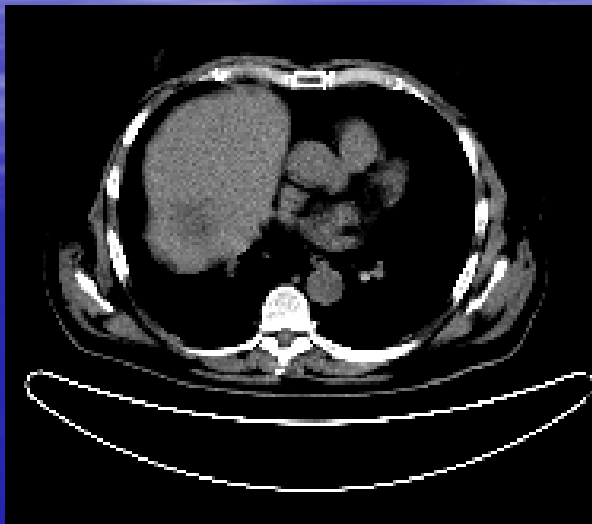
**TC : 2 nódulos tratados
+
1 novo nódulo**



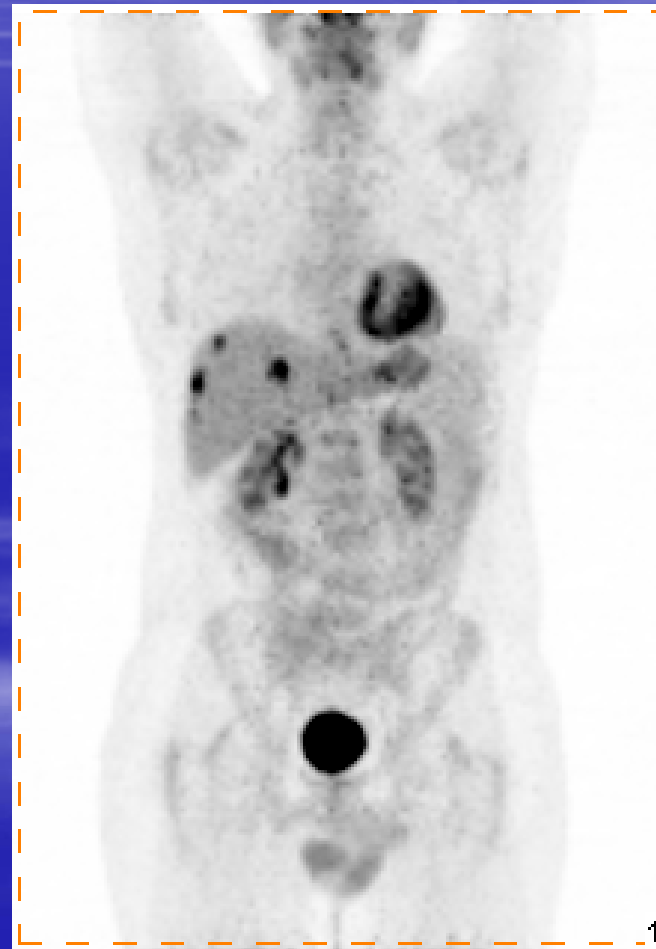
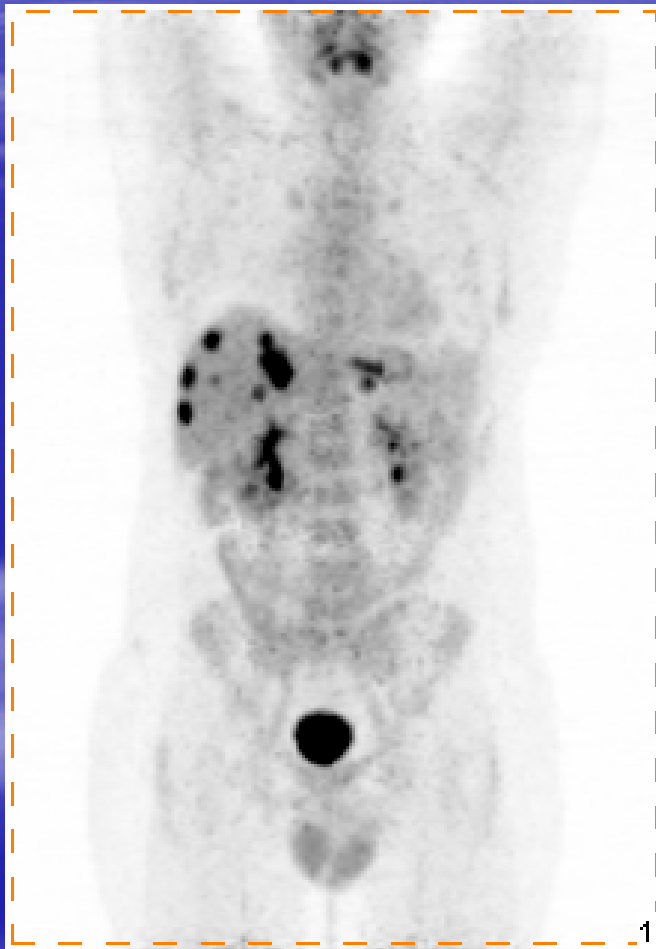
Metástase Hepática: Ca de colon



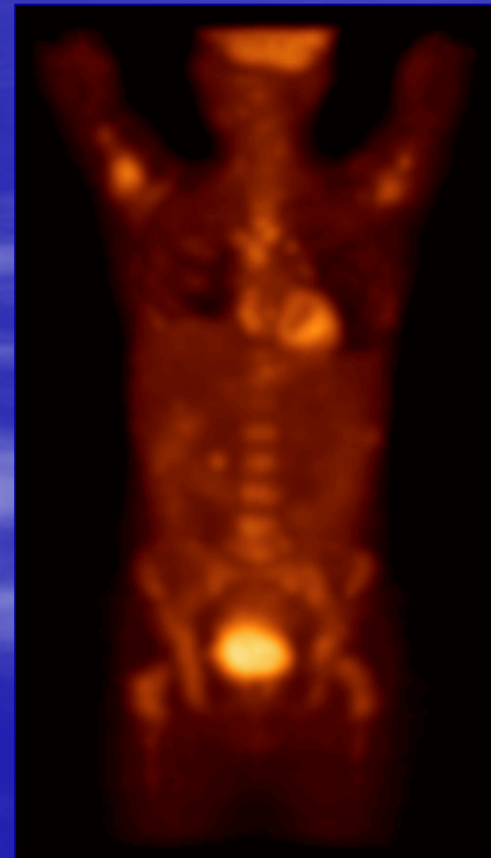
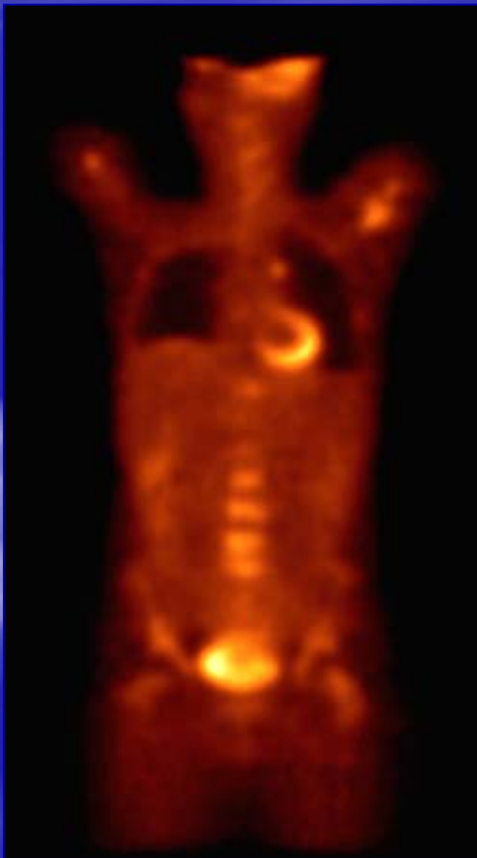
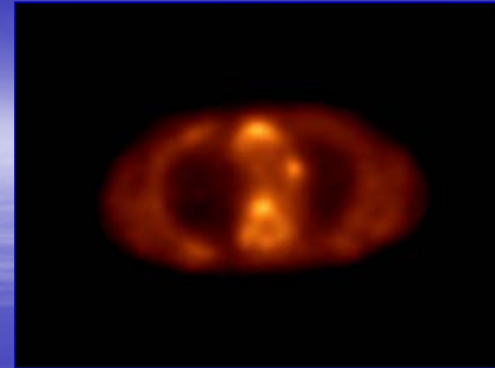
Metástase hepática: ca de colon



Metástases hepáticas



CVF



TC de torax



MB, 44 anos, masc

**Ca indiferenciado de
grandes células**

18F-FDG

TRANSVERSAL

74

D

E

75

CORONAL

74

75

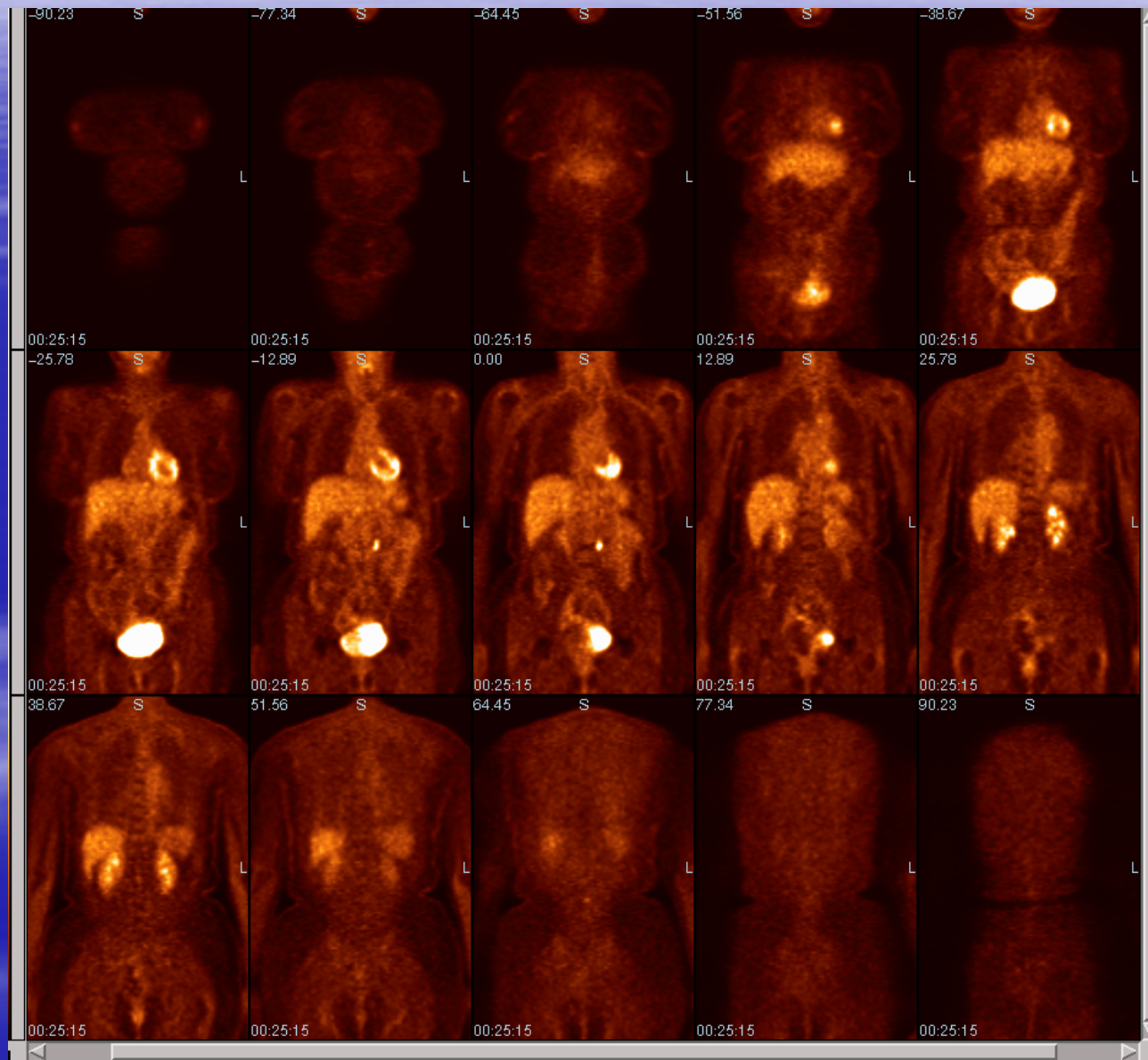
SAGITAL

81

82

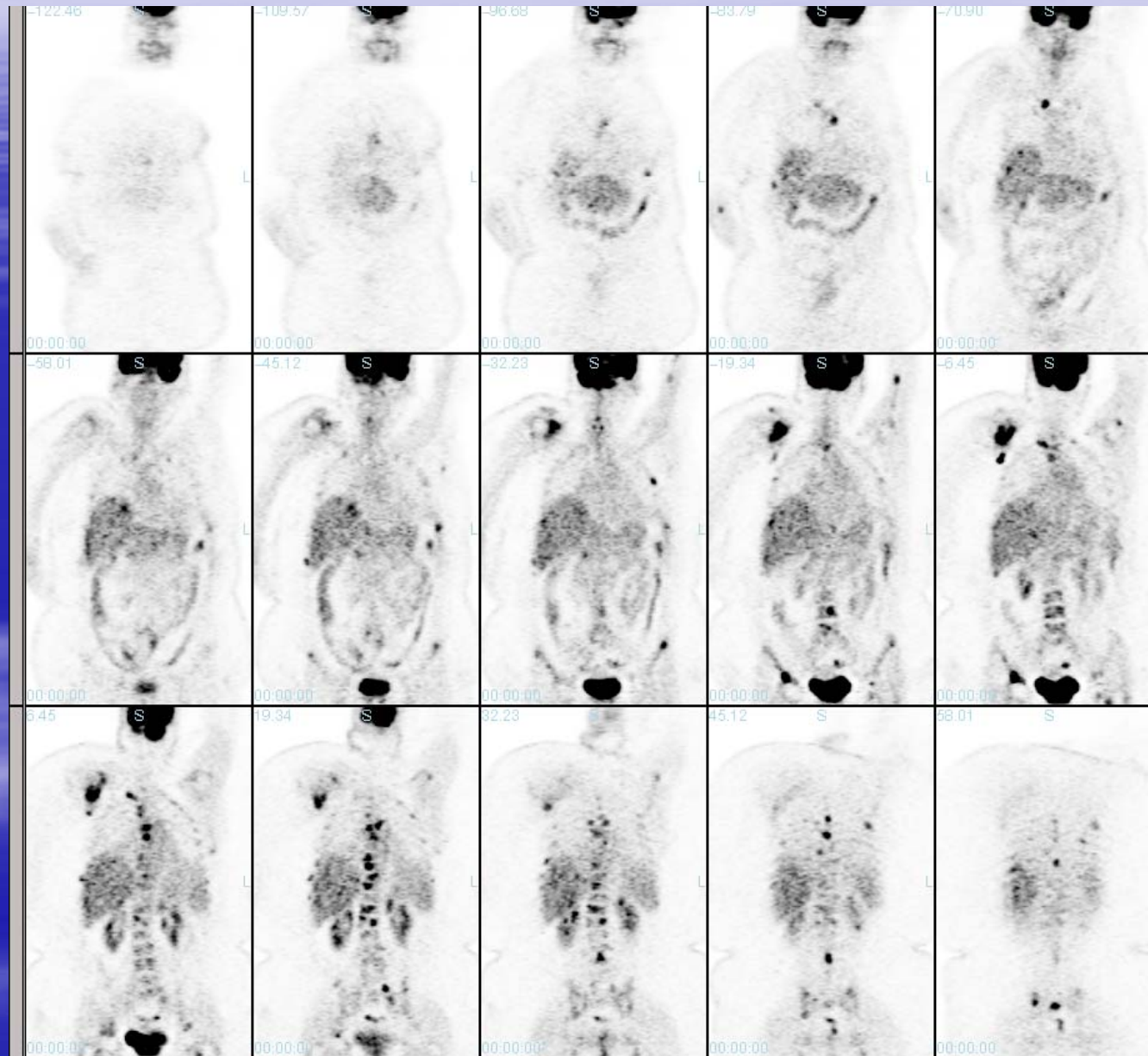
PET

LS
52 F
Ca Ov



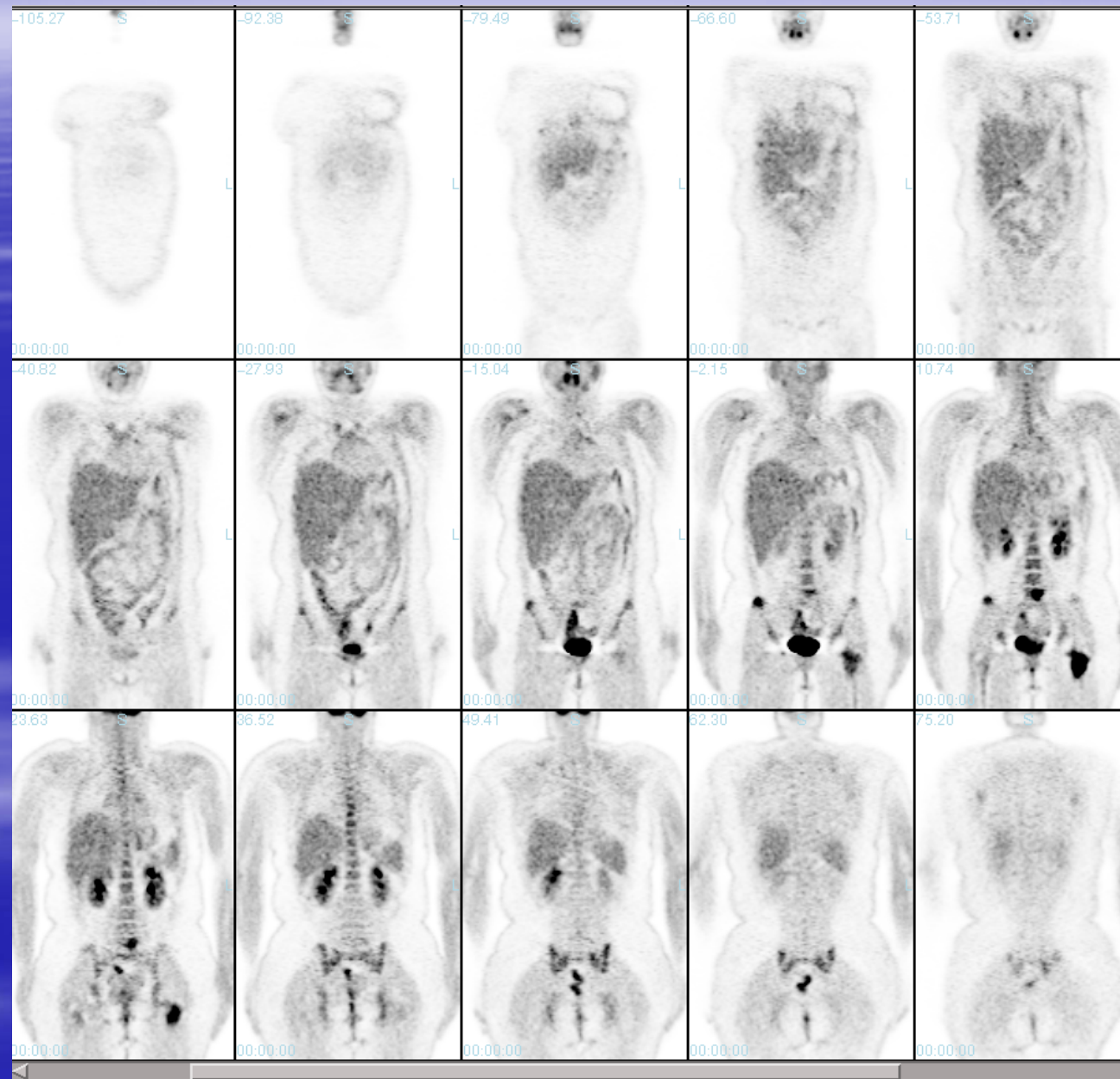
ALP
56F
Mama

PET



PET

RNBM
Mama IIB



Viabilidade com FDG x Protocolos

◆ Jejum:

- Captação baixa pelo miocárdio normal
- Grau de captação é variado
- Distribuição é heterogênea

◆ Jejum + Glicose:

- Acentua a diferença de captação entre miocárdio viável e cicatricial

◆ Jejum + Glicose + Insulina:

- Necessários nos pacientes com baixa resposta na liberação de insulina

◆ "Clamping" insulínico - euglicêmico:

- Indispensável no diabético.
- Facilita a padronização e interpretação das imagens.

Viabilidade Miocárdica

Imagens Combinadas

→ ^{13}N - Amônia -PET X $^{99\text{m}}\text{Tc}$ -MIBI-SPECT

MIBI superestima defeitos nas paredes septal e inferior do VE.

→ ^{18}F FDG-PET X $^{99\text{m}}\text{Tc}$ -MIBI-SPECT

Correção de atenuação deve ser considerada para não superestimar áreas viáveis.

- Sand and cols - J Nucl Cardiol 1998

IMAGENS DE PET: PERFUSÃO E METABOLISMO DE GLICOSE

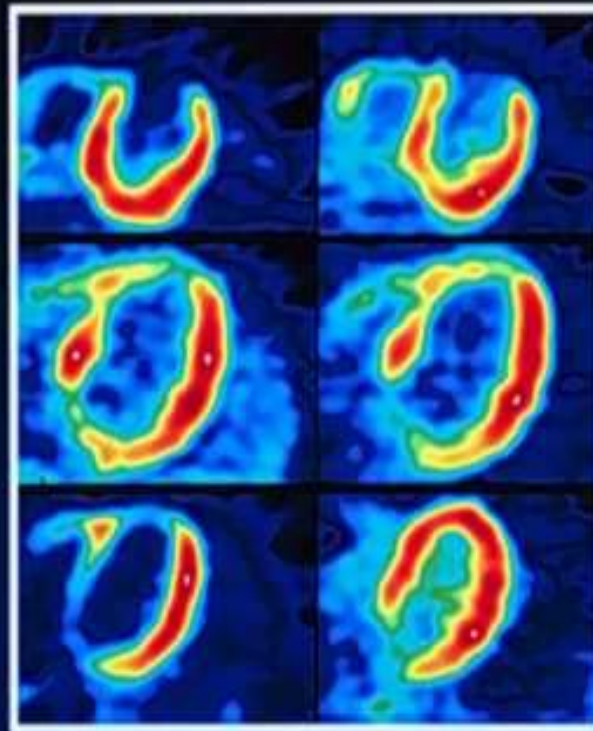
PET Patterns

N-13
Ammonia

F-18
Deoxyglucose

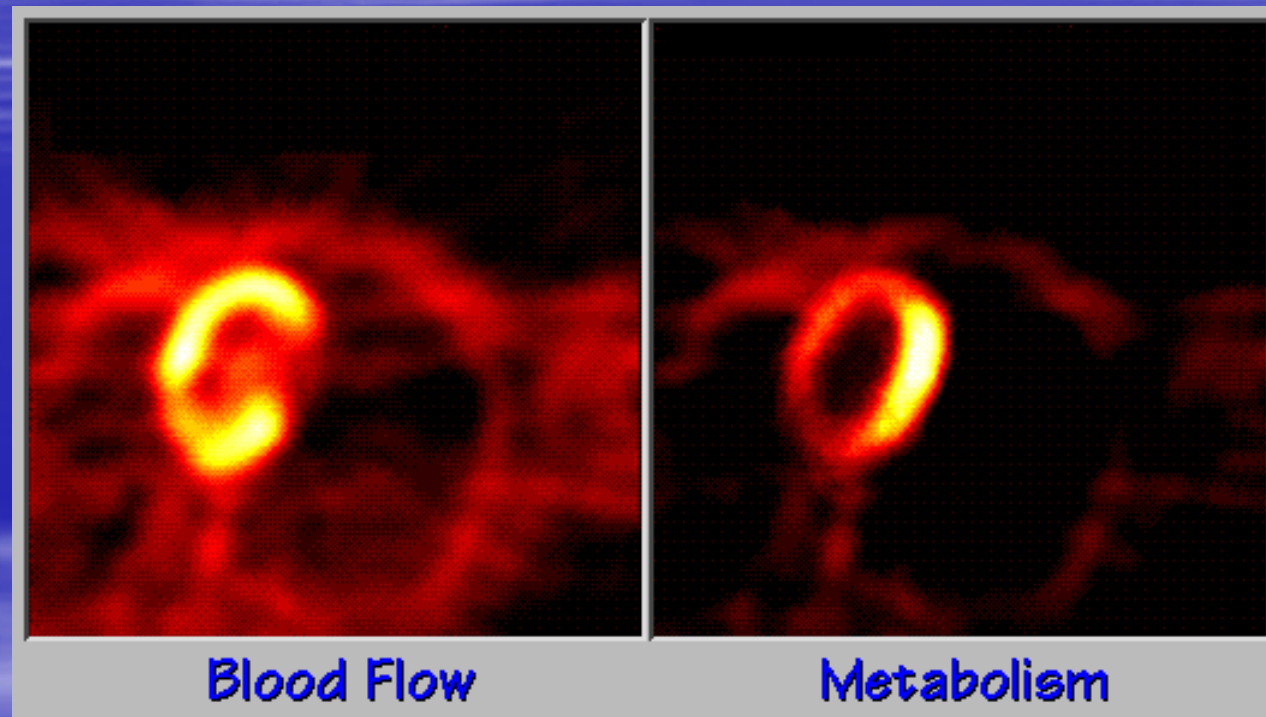
Match

Mismatch



Aplicações em Cardiologia

Viabilidade
miocárdica
(Mismatch)



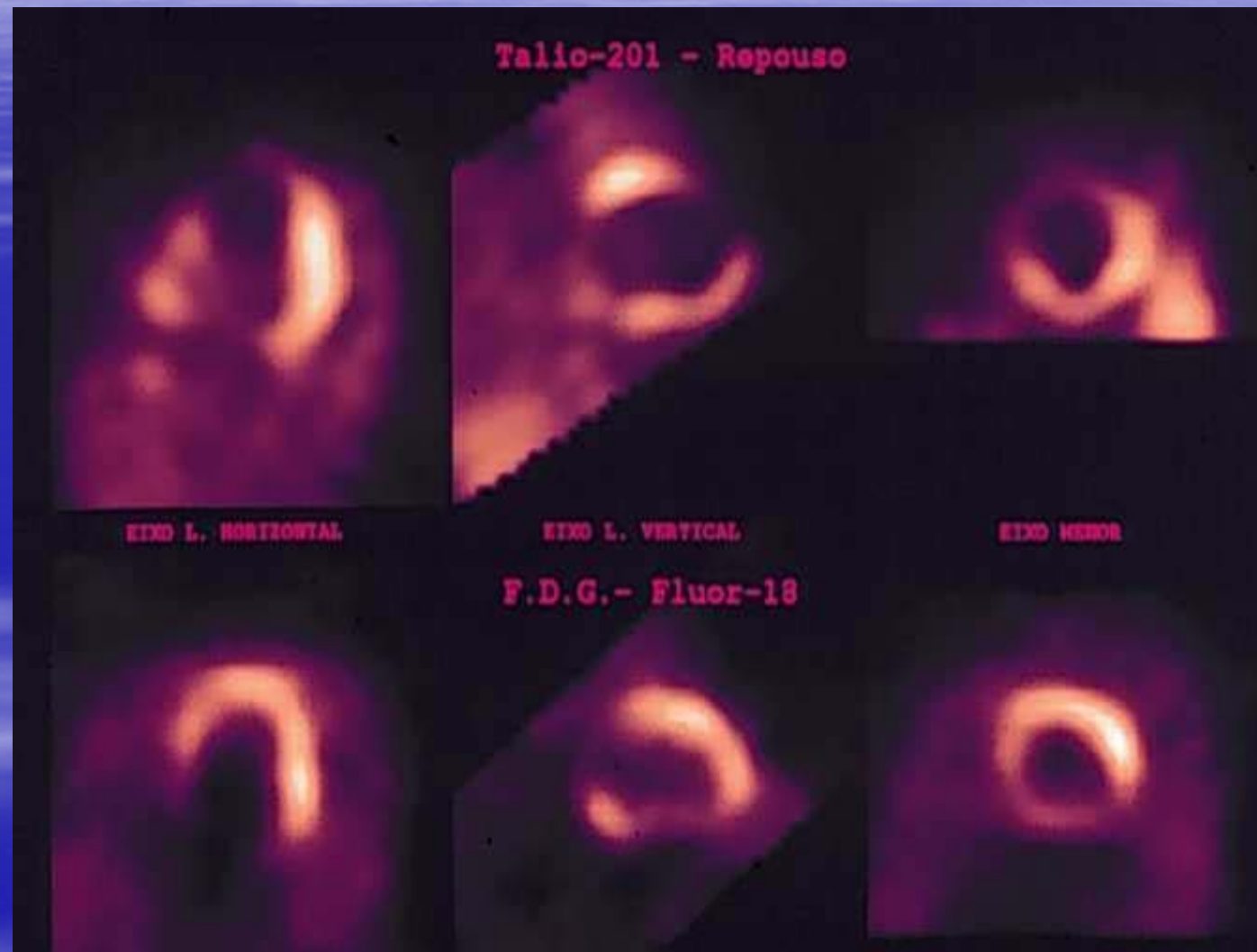
NH3 – N13

FDG – F18

VIABILIDADE MIOCÁRDICA: TÁLIO X GLICOSE

TÁLIO-201

^{18}F FDG

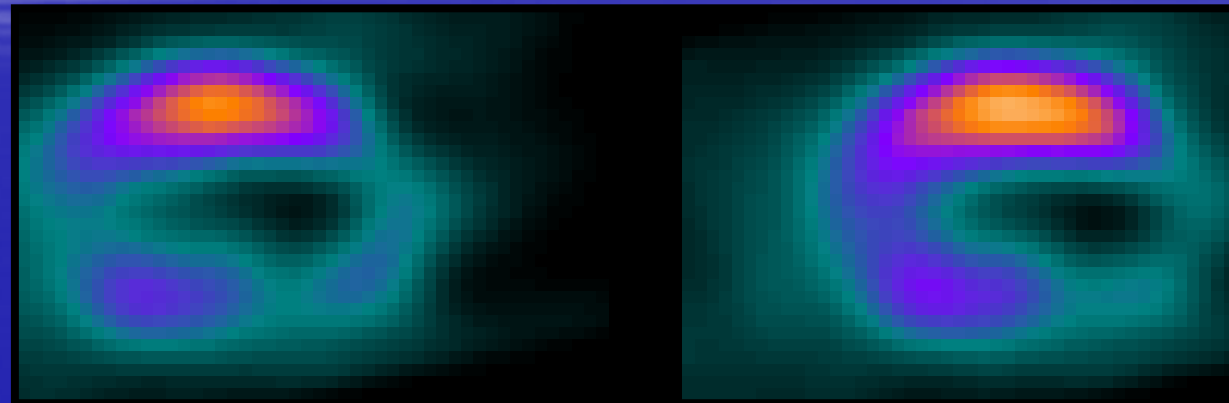


INCOR

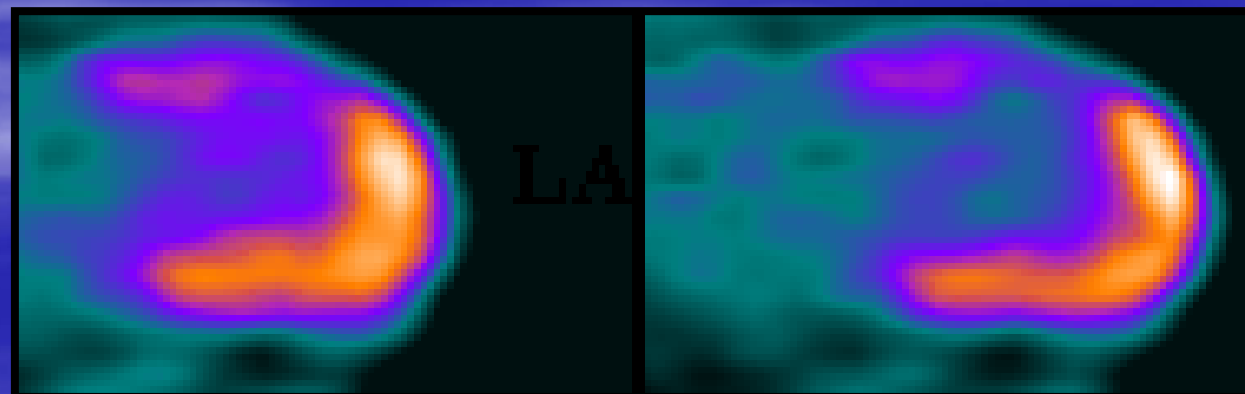
SPL



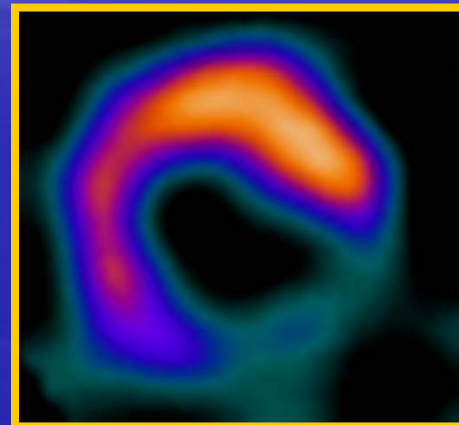
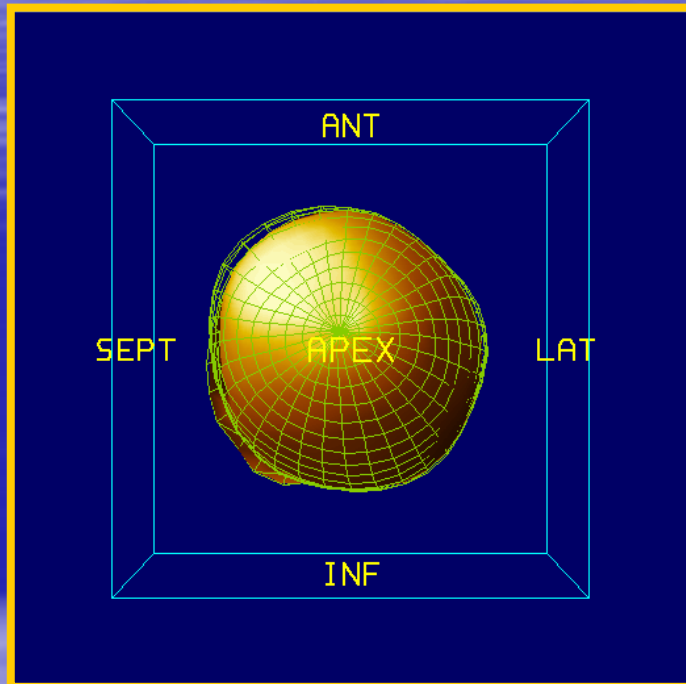
Perfusão



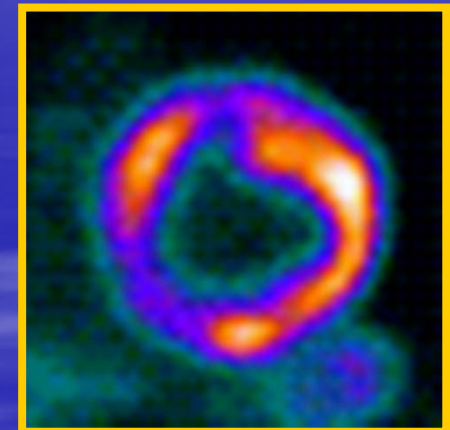
Met Glicose
FDG-F18
PET



AZ

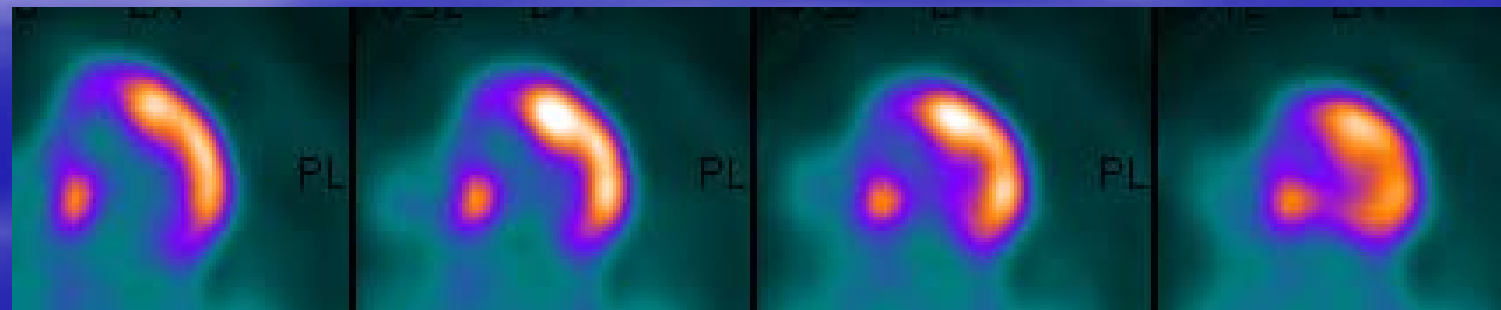
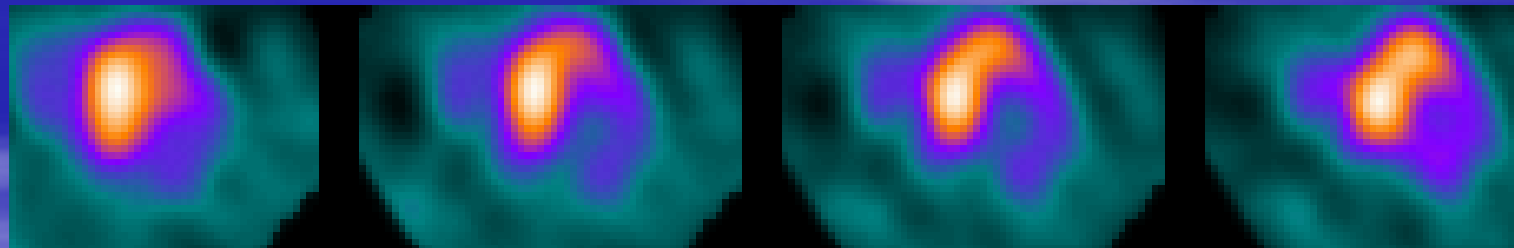
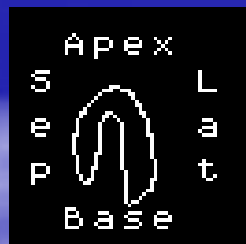
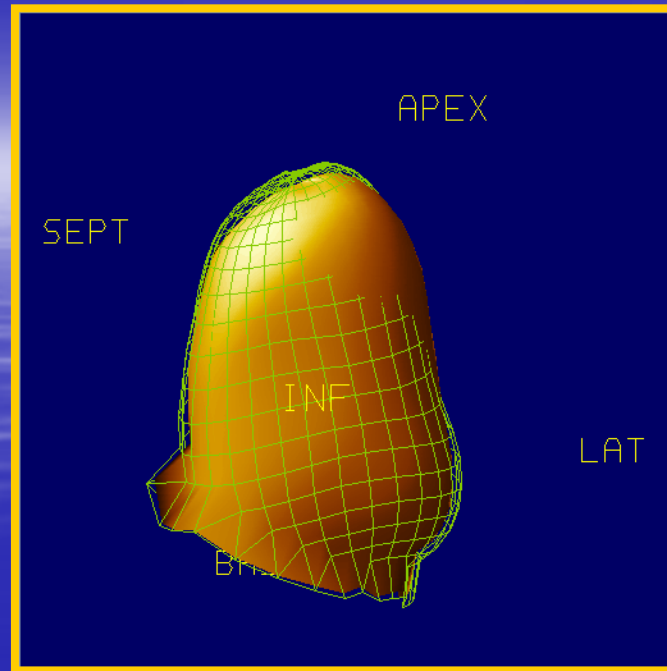


Perfusão

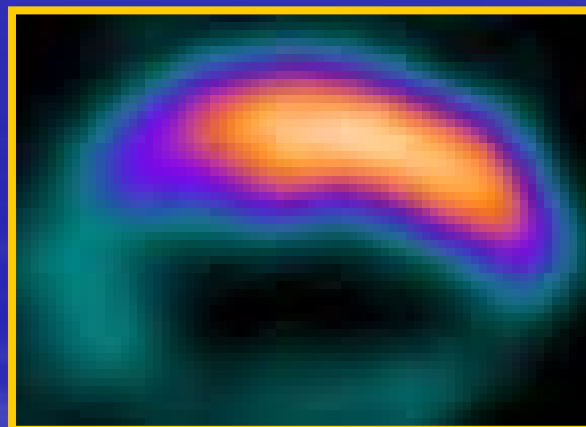
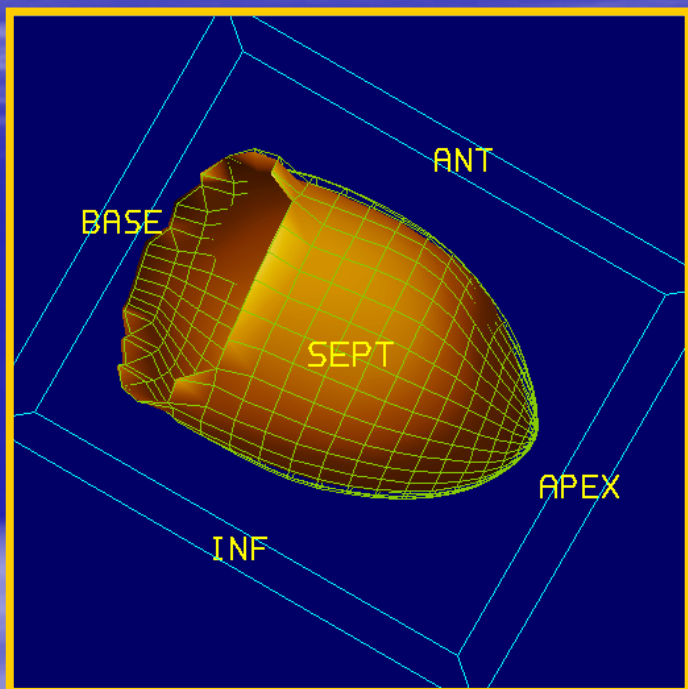


MetGlicose
FDG-PET

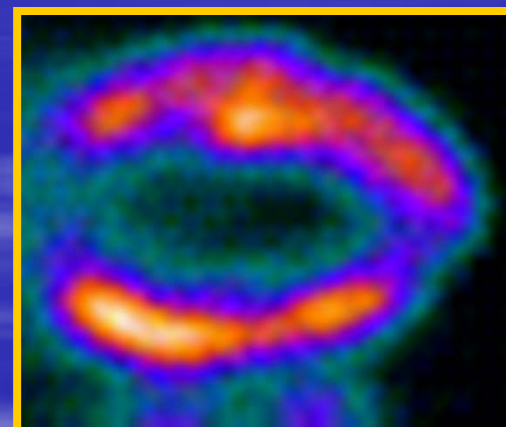
VSC



AZ

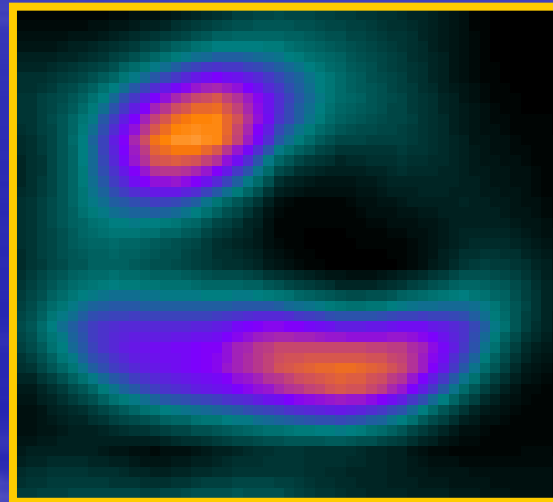
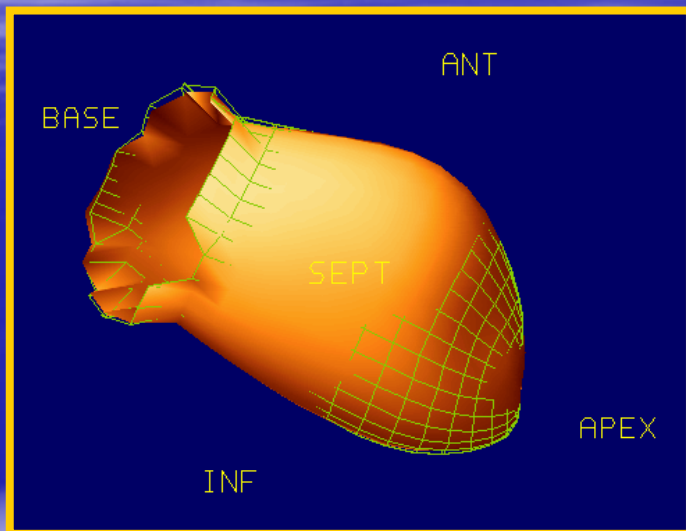


Perfusão

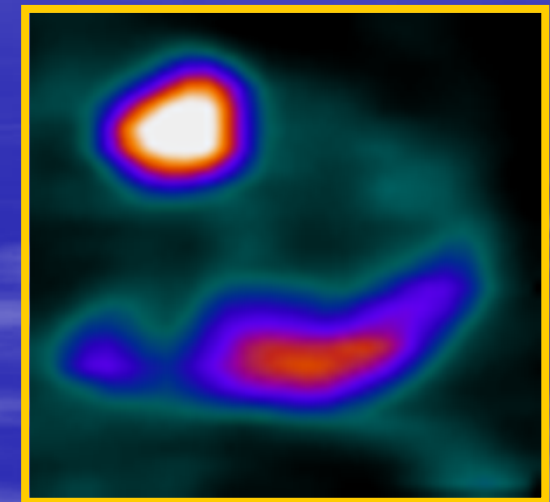


MetGlicose
FDG-PET

ML

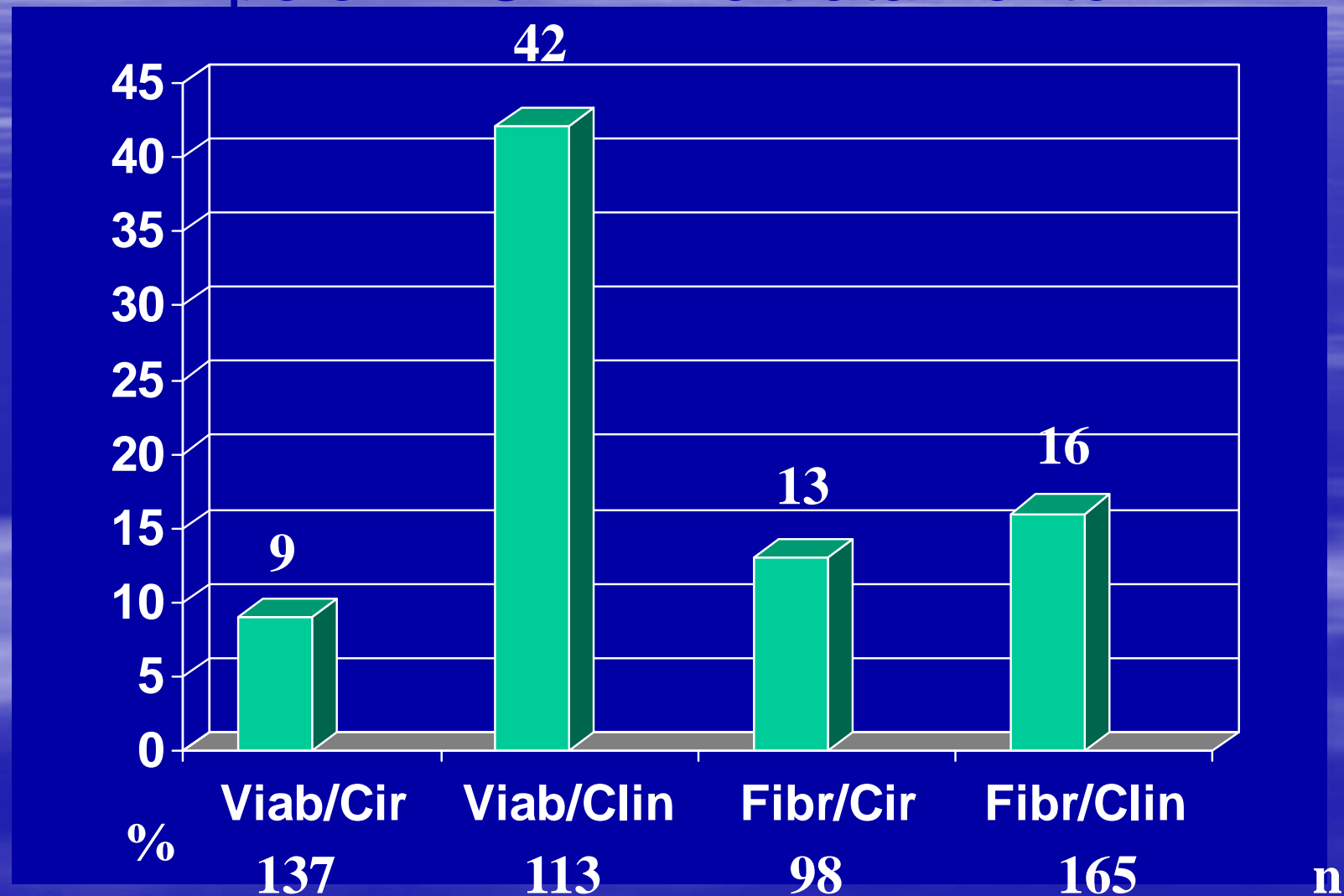


PERFUSÃO



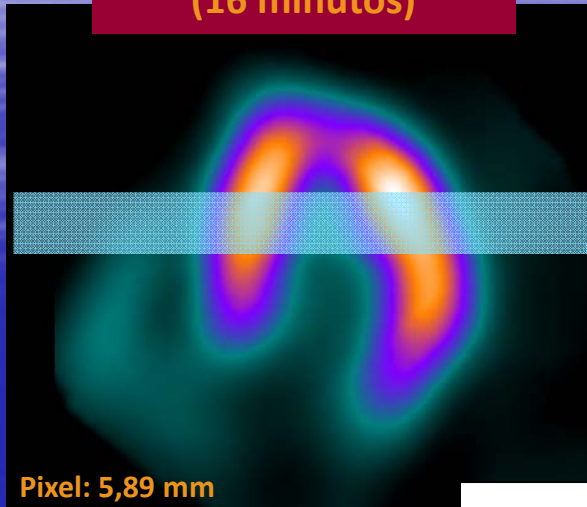
MET GLICOSE
FDG-PET

% Eventos de acordo com a
presença/ausência de músculo viável
pelo FDG-PET e tratamento

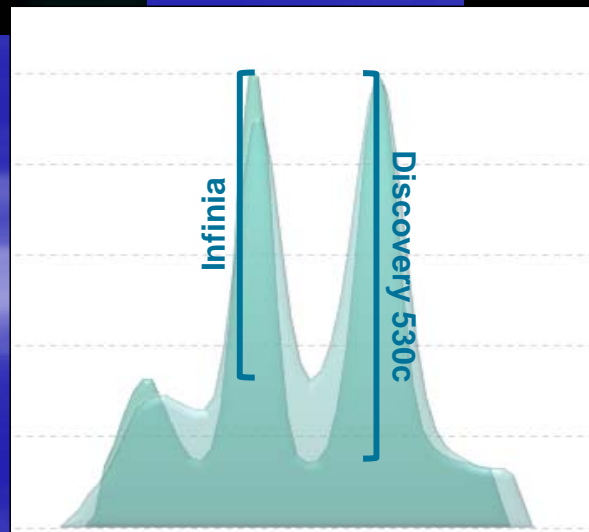
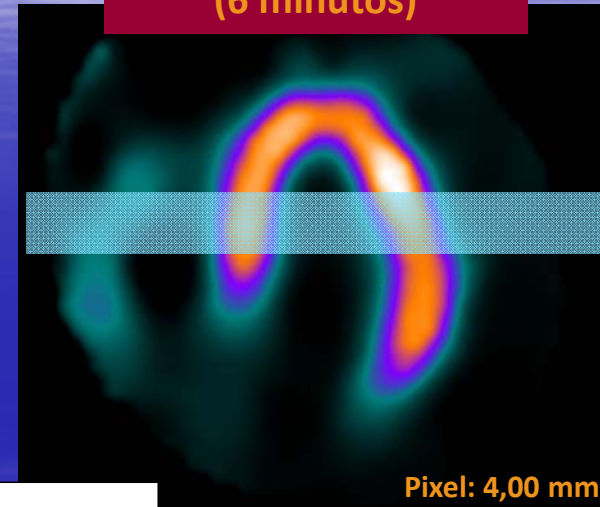


Discovery™ NM 530c – Hospital Israelita Albert Einstein

**Infinia HK4
(16 minutos)**

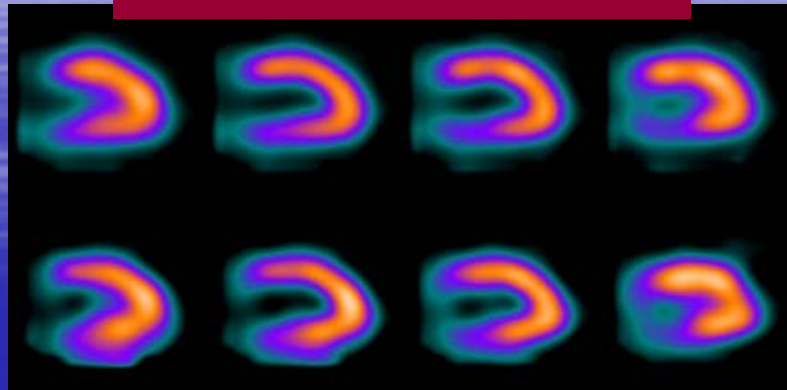


**Discovery 530c
(6 minutos)**



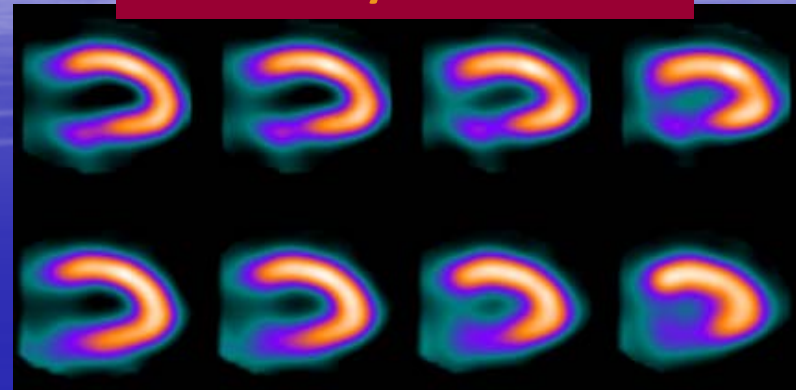
Discovery™ NM 530c – Hospital Israelita Albert Einstein

Câmara convencional



Repouso: 10 mCi / Estresse: 30 mCi
Tempo aquisição: 17 minutos

Discovery™ NM 530c



Repouso: 6 mCi / Estresse: 18 mCi
Tempo aquisição: 6 minutos

TRAÇADORES DE PERFUSÃO PARA PET

OS TRAÇADORES MAIS USADOS SÃO:

H_2O^{15} MEIA VIDA = 127 SEGUNDOS

$^{13}\text{NH}_3$ MEIA VIDA = 10 MINUTOS

^{82}Rb MEIA VIDA = 76 SEGUNDOS

$^{18}\text{F-X}$ MEIA VIDA = 110 MINUTOS

**SOMENTE RUBÍDIO NÃO NECESSITA
CICLOTRON. É OBTIDO COM GERADOR
DENTRO DA SALA.**

Vantagens das Imagens Cardíacas de Perfusão com PET

- Melhor eficiência
- Menor dose de exposição
- Menos artefatos de atenuação
- Melhor resolução espacial e contraste

***Quantificação do fluxo sanguíneo regional miocárdico
(ml/min/g)***

SPECT X PET

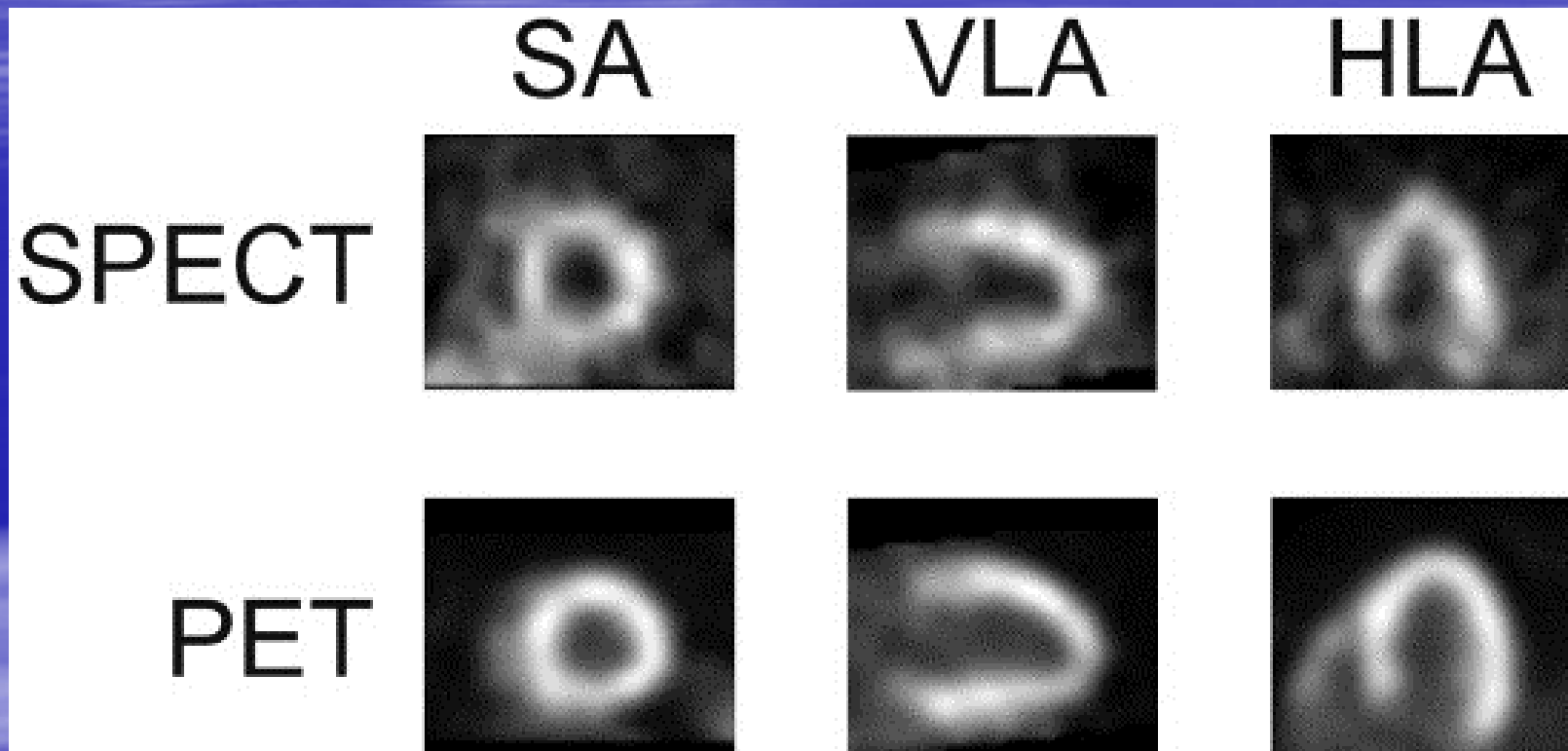
PERFUSÃO MIOCÁRDICA DE REPOUSO
PERFUSÃO MIOCÁRDICA DE ESTRESSE
VOLUME DIASTÓLICO
VOLUME SISTÓLICO
FRAÇÃO DE EJEÇÃO
DÉBITO CARDÍACO

DIFERENÇAS ENTRE SPECT E PET

PET TEM CORREÇÃO DE ATENUAÇÃO
NÃO UNIFORME. MAIS ACURADA.
MELHOR QUANTIFICAÇÃO DE
PARÂMETROS FISIOLÓGICOS DO QUE
SPECT

QUANTIFICAÇÃO ABSOLUTA E NÃO
INVASIVA DO FLUXO SANGUÍNEO
MIOCÁRDICO (ml/g/min)
QUANTIFICAÇÃO ABSOLUTA DA
RESERVA CORONARIANA

Perfusão Miocárdica PET



^{82}Rb

Sensibilidade & Especificidade

Autor	Sensib	Especif	# Pts
Gould	95%	100%	50
Demer	94%	95%	193
Go	93%	78%	202
Schelbert	97%	100%	45
Yonekura	93%	100%	49
Williams	98%	93%	146
Stewart	84%	88%	319
Média.	93% +/- 8	92% +/- 5	766

Perfusão Miocárdica PET

Gerador Rb 82

- Rubídio-82 (Rb-82) é produzido pelo decaimento do estrôncio-82 (Sr-82)
- 75 seg $T_{1/2}$
- Cinética:
 - Análogo ao K
 - Alta taxa de extração
- Defeitos visibilizados 2-7 minutos após Inj
- Mesma dose estresse e repouso
- Estresse farmacológico



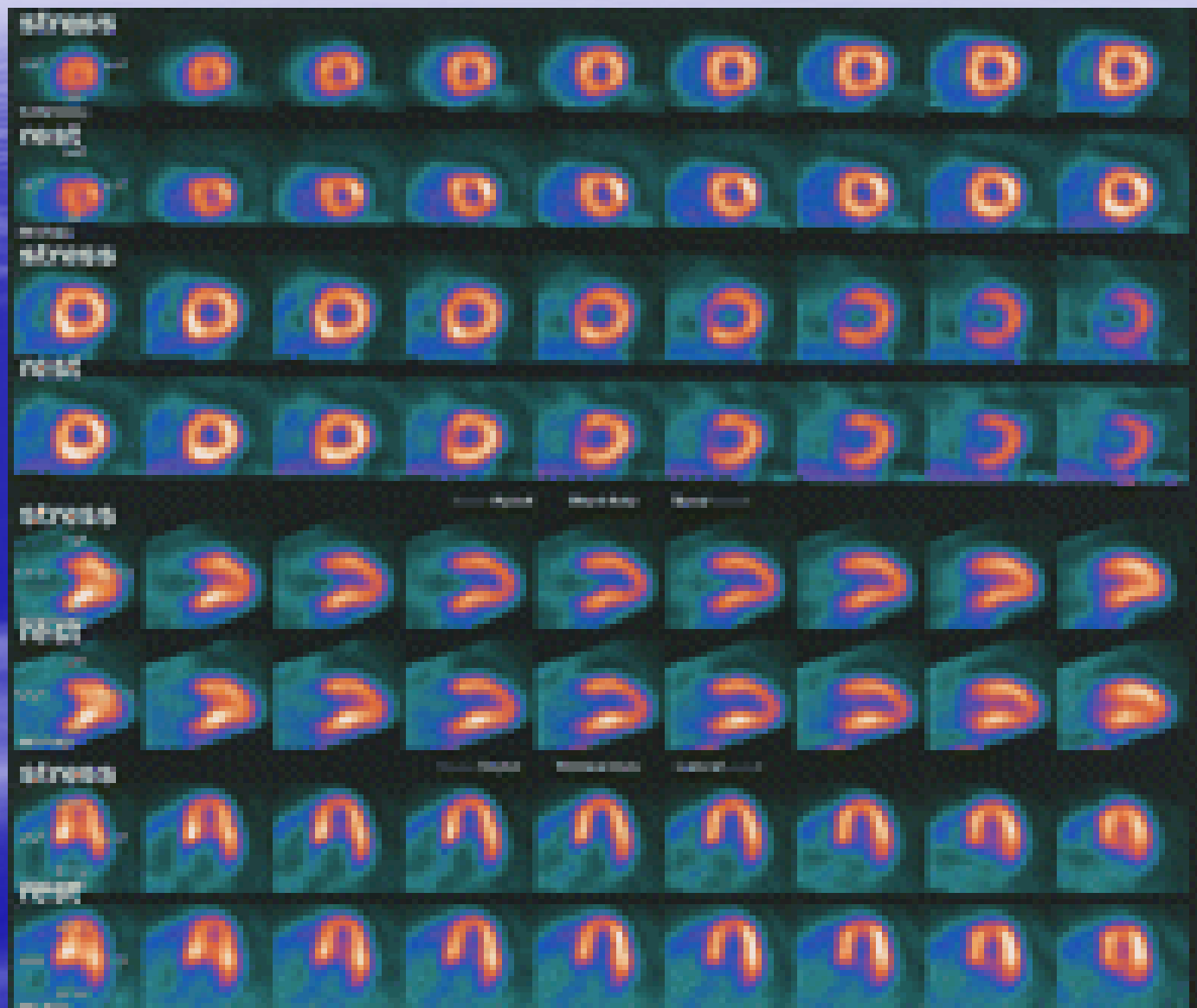
Tempo do estudo : 25 minutos

Avaliação acurada da perf e função : obesos, mulheres, estresse farmacológico

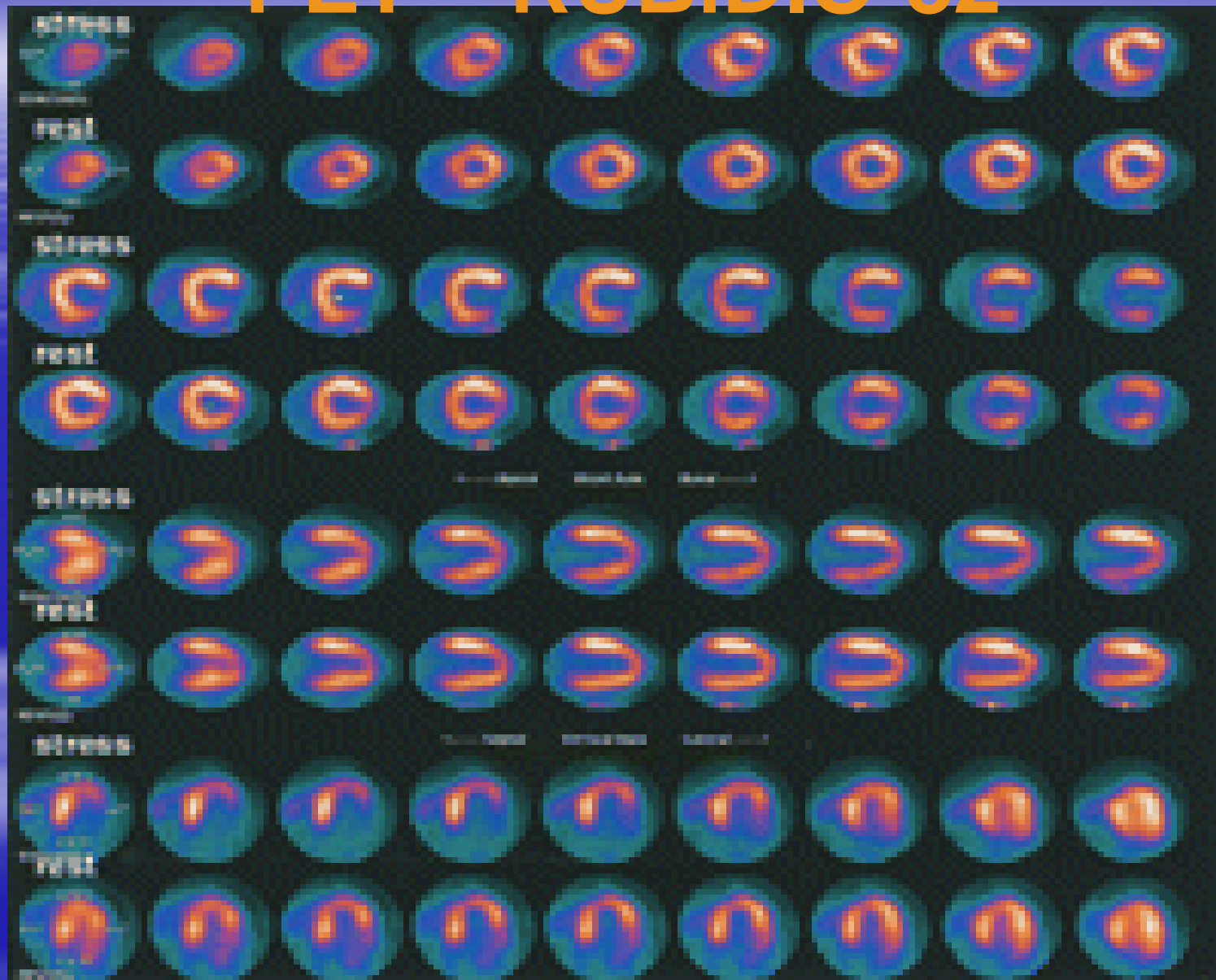
PET/CT

Quantificação do fluxo sanguíneo miocárdico

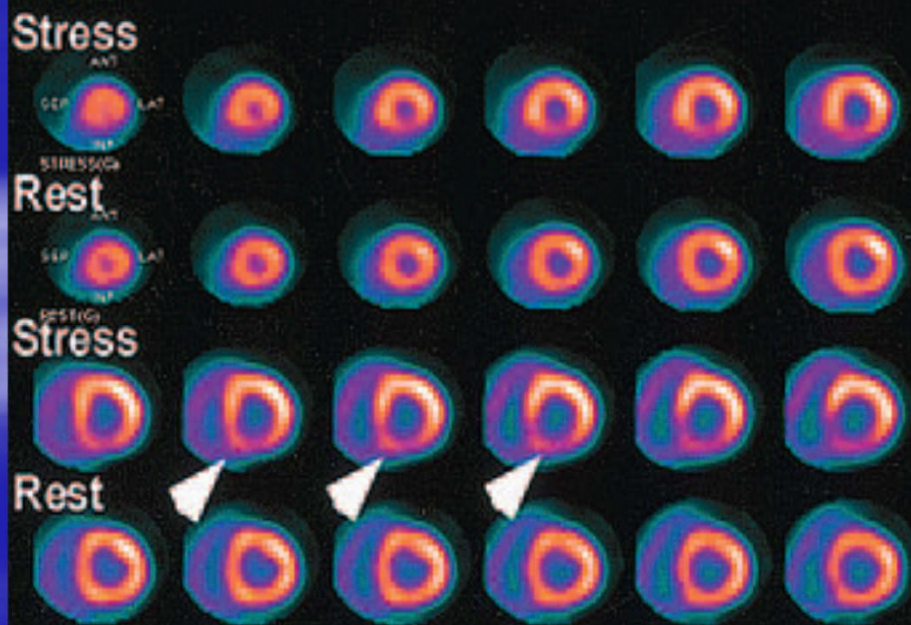
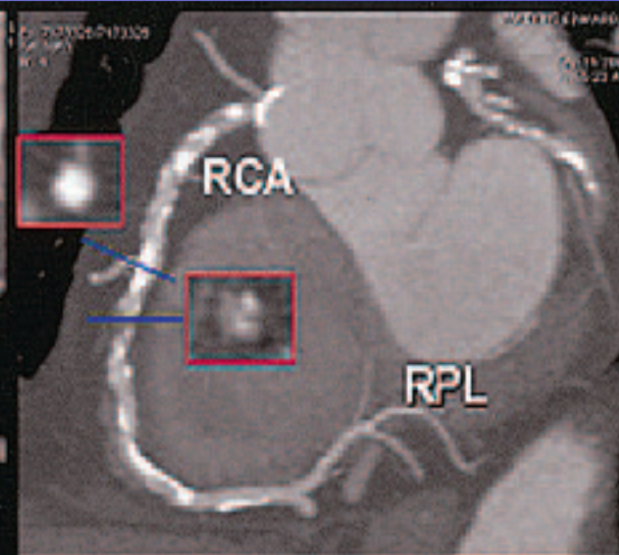
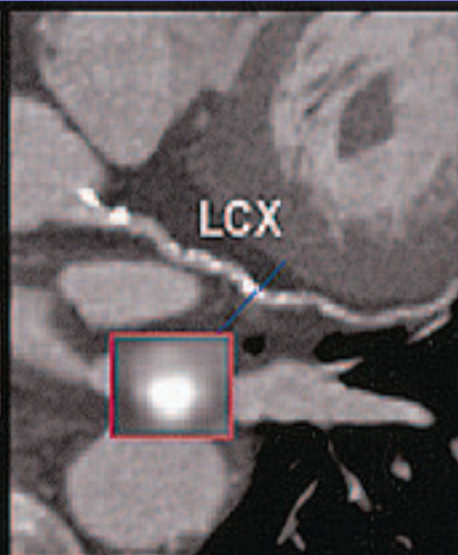
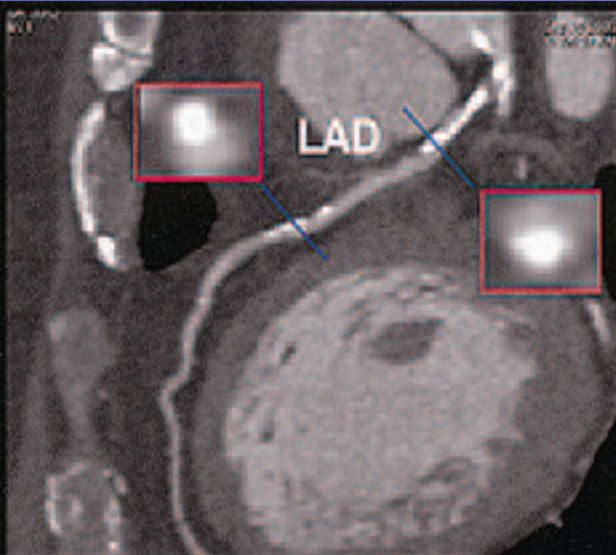
PET – RUBÍDIO-82



PET – RUBÍDIO-82

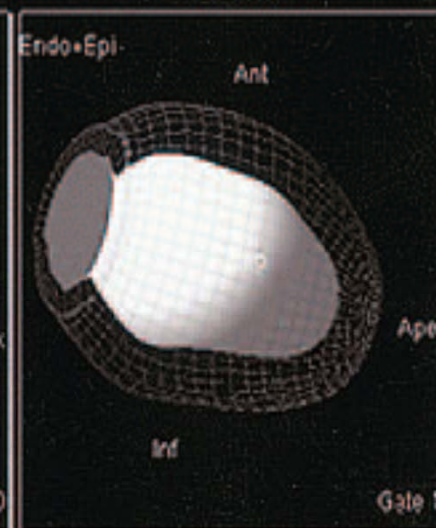
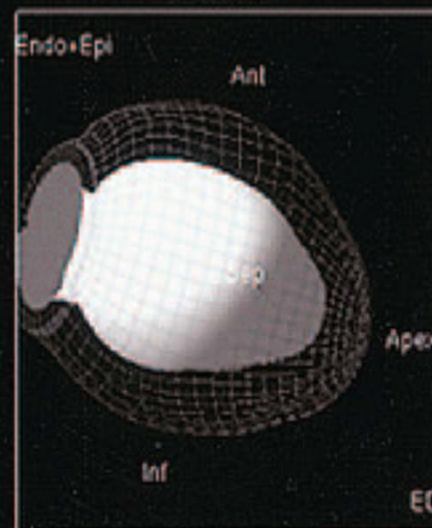


PET-CT



Baseline LVEF
54%

Peak stress LVEF
63%



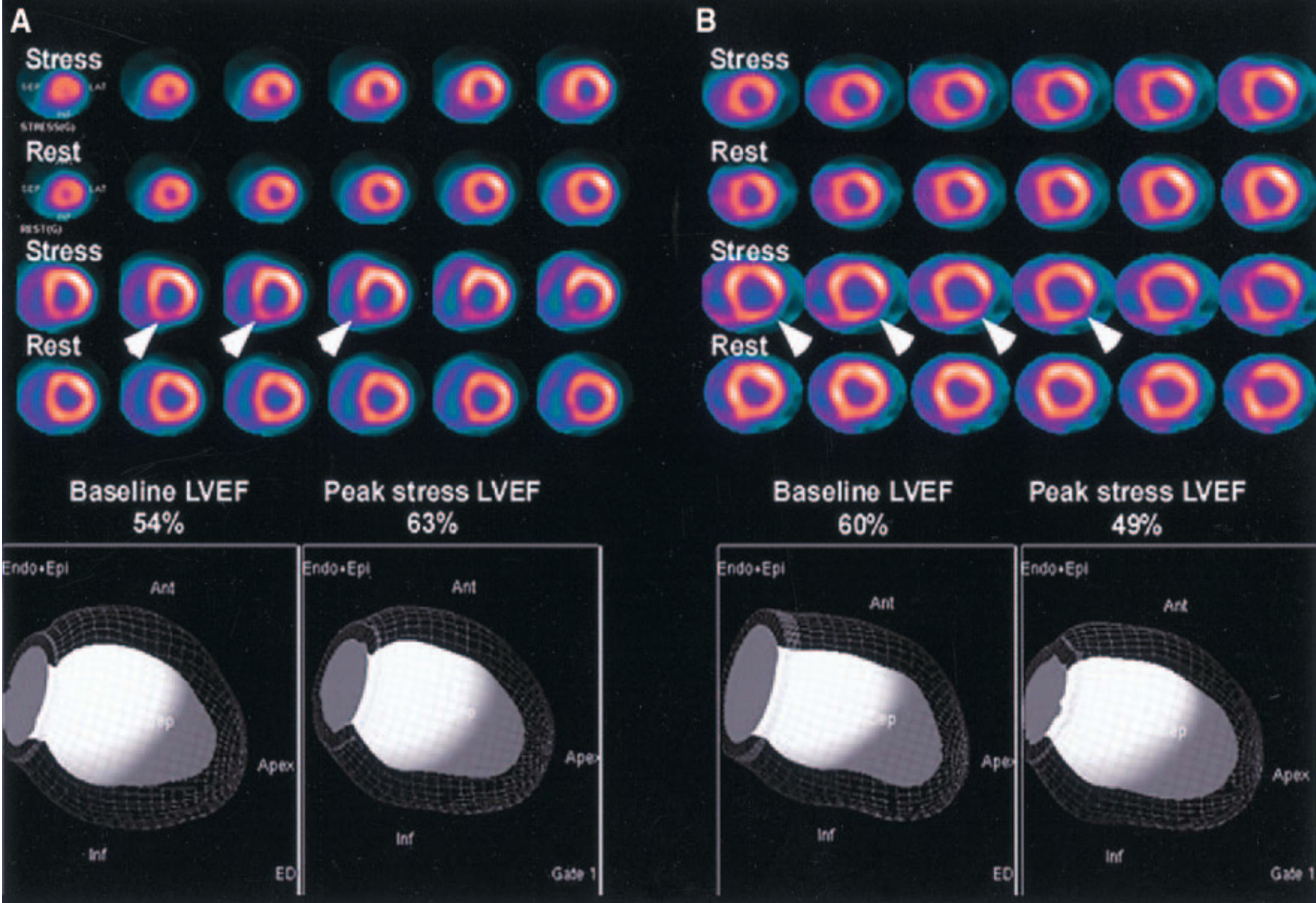
Reduced Myocardial Flow Reserve Quantified With Rubidium-82 PET is an Independent Predictor of Three Vessel Coronary Artery Disease

Maria C Ziadi¹; Robert A deKemp²; Rebecca E Tee³; Kathryn Williams³; Ann Guo³; Jennifer M Renaud³; Benjamin J Chow³; Terrence D Ruddy³; Renee Hessien³; Ross A Davies³; Judy Etele³; Linda Garrard³; Rob S Beanlands³

¹ Univ of Ottawa heart Institute, Ottawa, Canada

N=112	Patients without $\geq 70\%$ 3-vessel CAD (n=88)	Patients with $\geq 70\%$ 3-vessel CAD (n=24)
Age, mean (SD)	61 (± 11)	69 (± 10) *
Diabetes, n (%)	25 (28%)	11 (46%) *
Hypertension, n (%)	54 (61%)	20 (83%) *
Positive Family Hx, n (%)	40 (45%)	17 (71%) *
SSS, mean (SD)	7 (± 7)	12 (± 8) *
TID, n (%)	12 (14%)	8 (33%) *
Rest flow, mean (SD)	0.9 (± 0.3)	0.9 (± 0.3)
Stress flow, mean (SD)	2 (± 0.7)	1.1 (± 0.5) *
Global MFR, mean (SD)	2.2 (± 0.8)	1.2 (± 0.4) *

RUBÍDIO-82



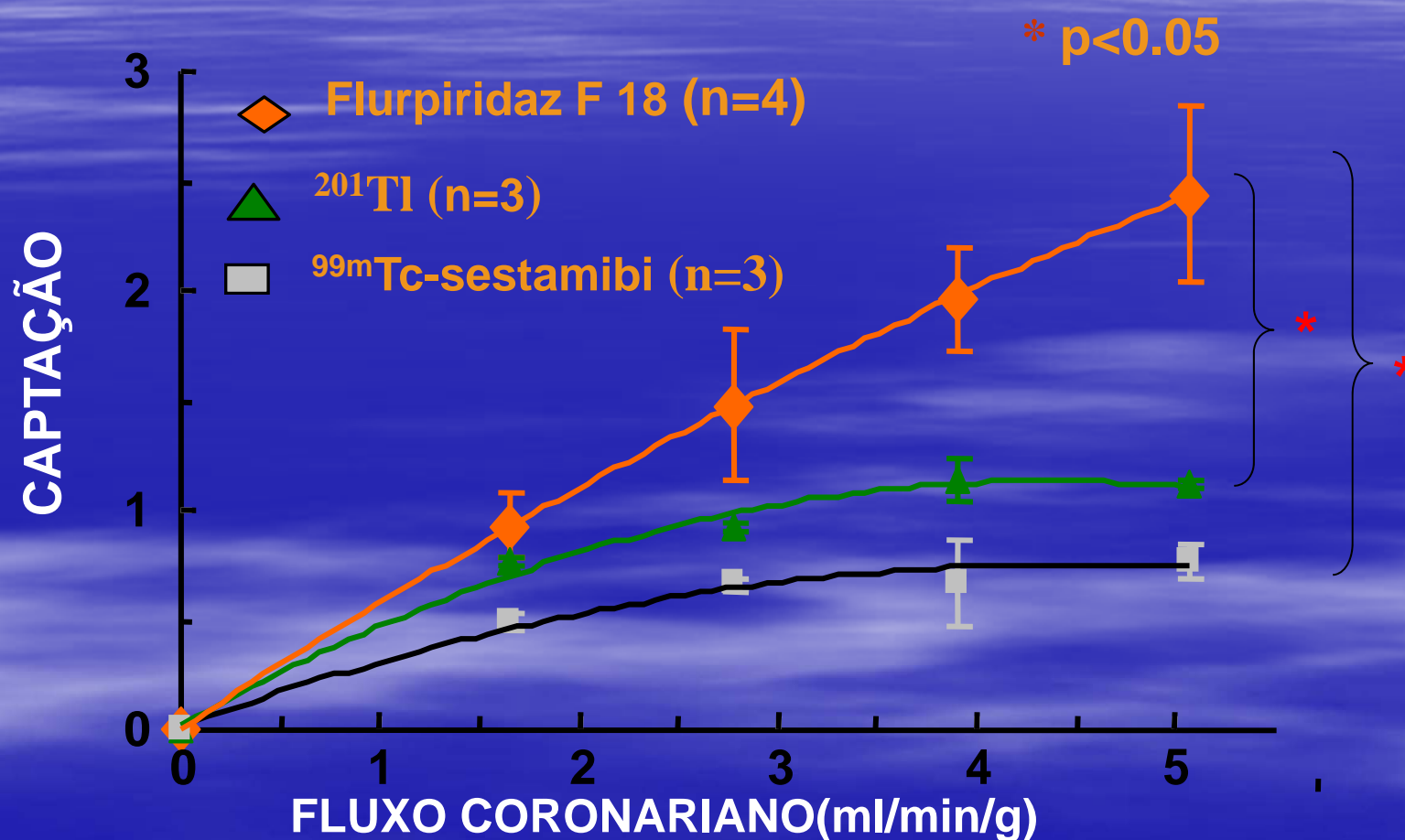
FLUORPIRIDAZ

POR QUE PERFUSÃO MIOCÁRDICA COM PET?

- PROPRIEDADES DO PET
 - ALTA RESOLUÇÃO ESPACIAL
 - MAIOR SENSIBILIDADE
 - CORREÇÃO DE ATENUAÇÃO VALIDADA
 - QUANTIFICAÇÃO DA PERFUSÃO MIOCÁRDICA E DA RESERVA DE FLUXO CORONARIANO
- ESTRESSE FÍSICO OU FARMACOLÓGICO
- ALTA ENERGIA DO FÓTON-
- REDUÇÃO DE ARTEFATOS

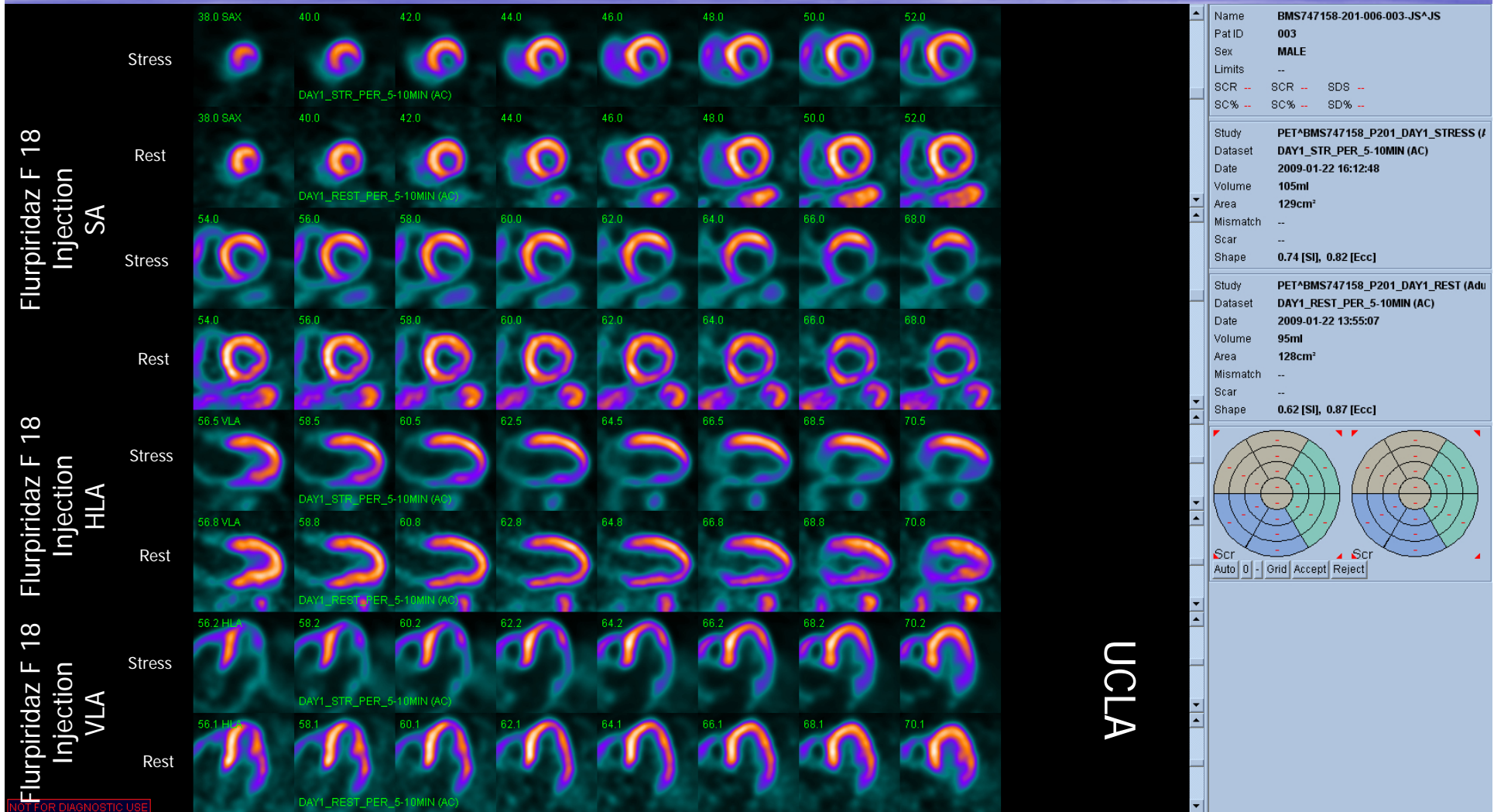
FLURPIRIDAZ

CAPTAÇÃO NA PRIMEIRA PASSAGEM EM COÊLHOS



Adapted from Yu, et al., *J Nucl Cardiol.* 2007;14(6):789-98

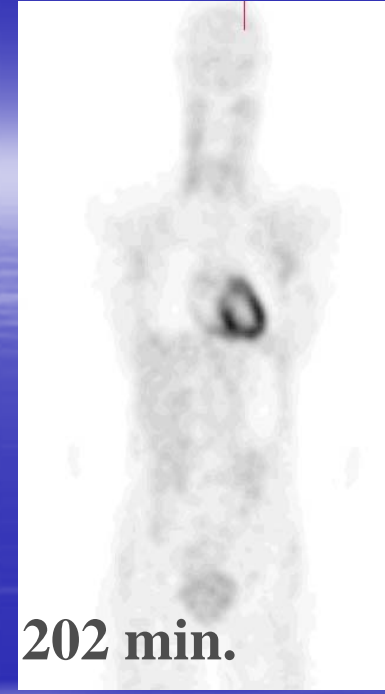
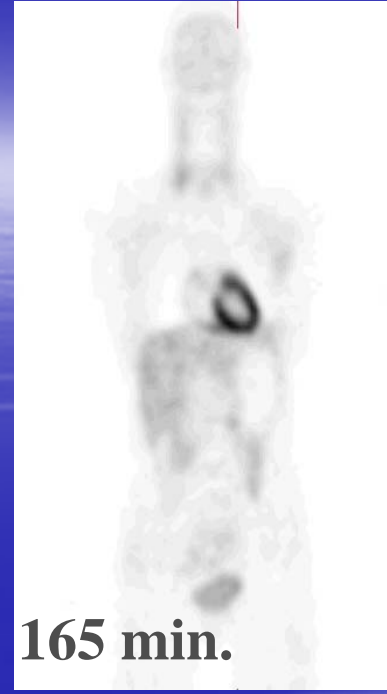
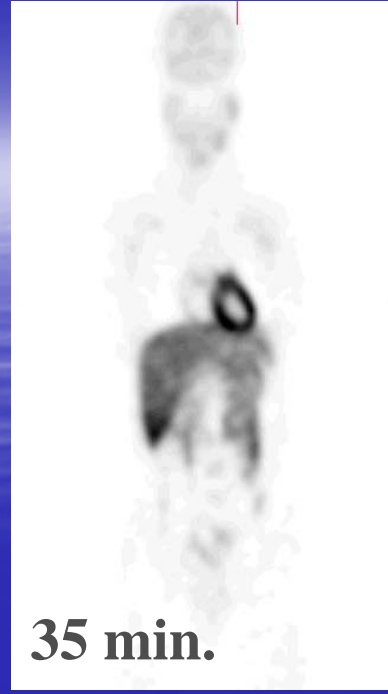
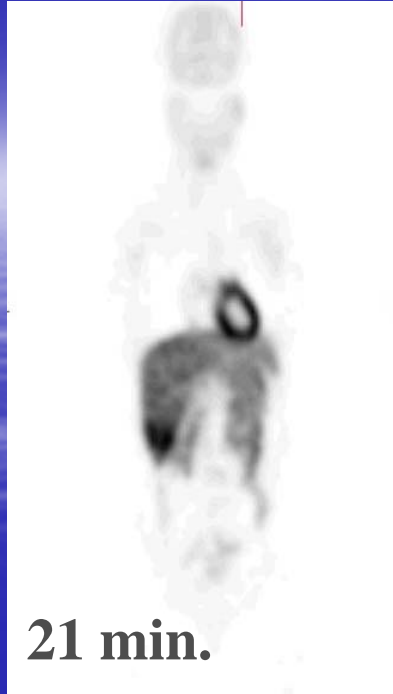
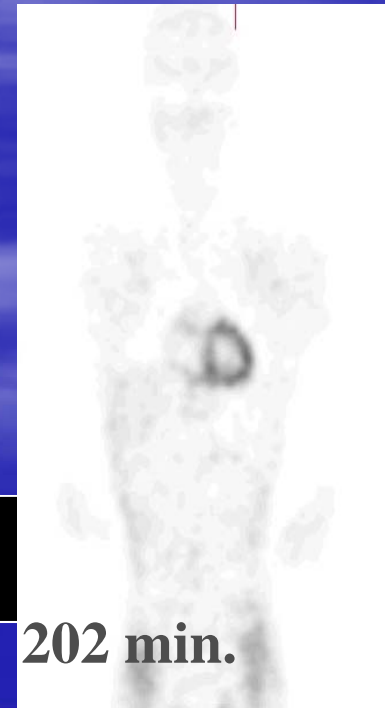
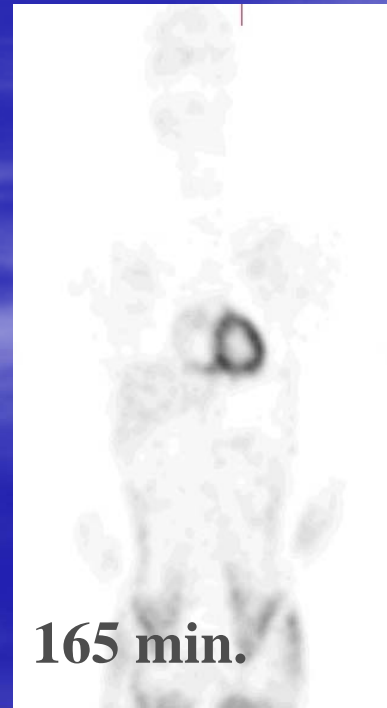
Study 201, Patient 006-003



Exercício

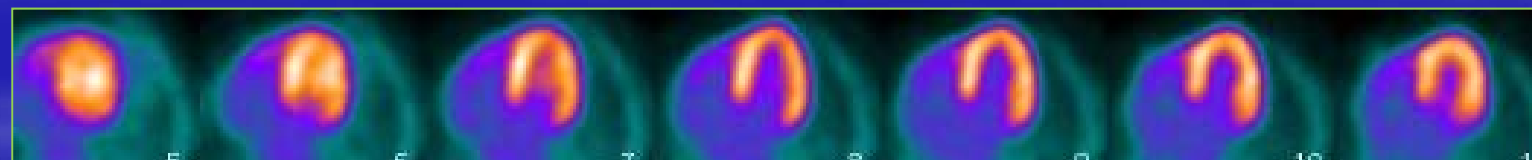
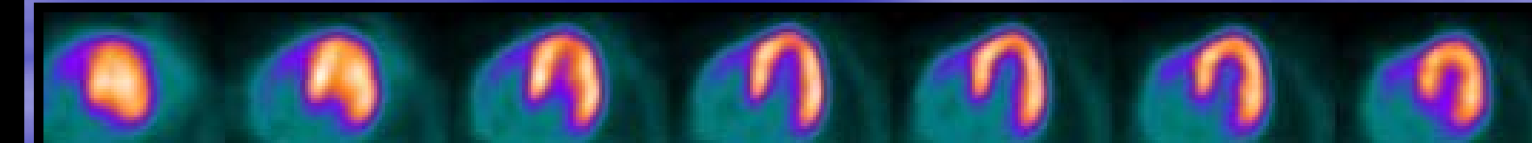
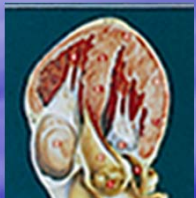
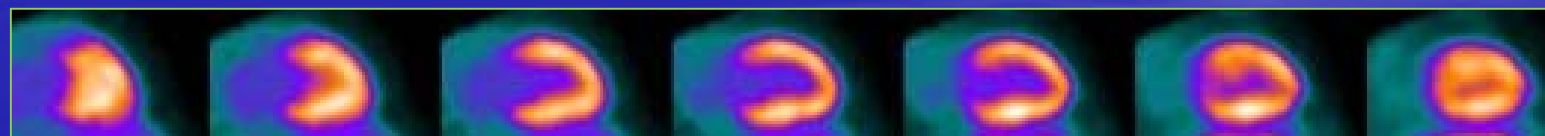
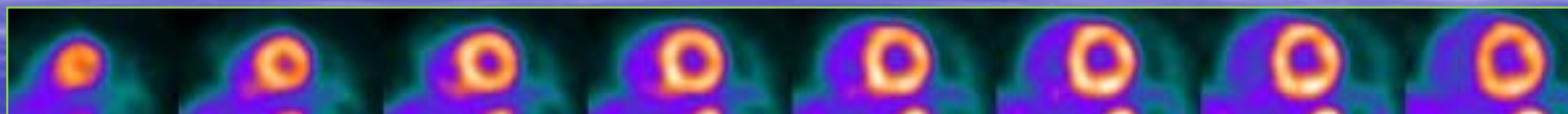
Adenosina

Flurpiridaz F 18

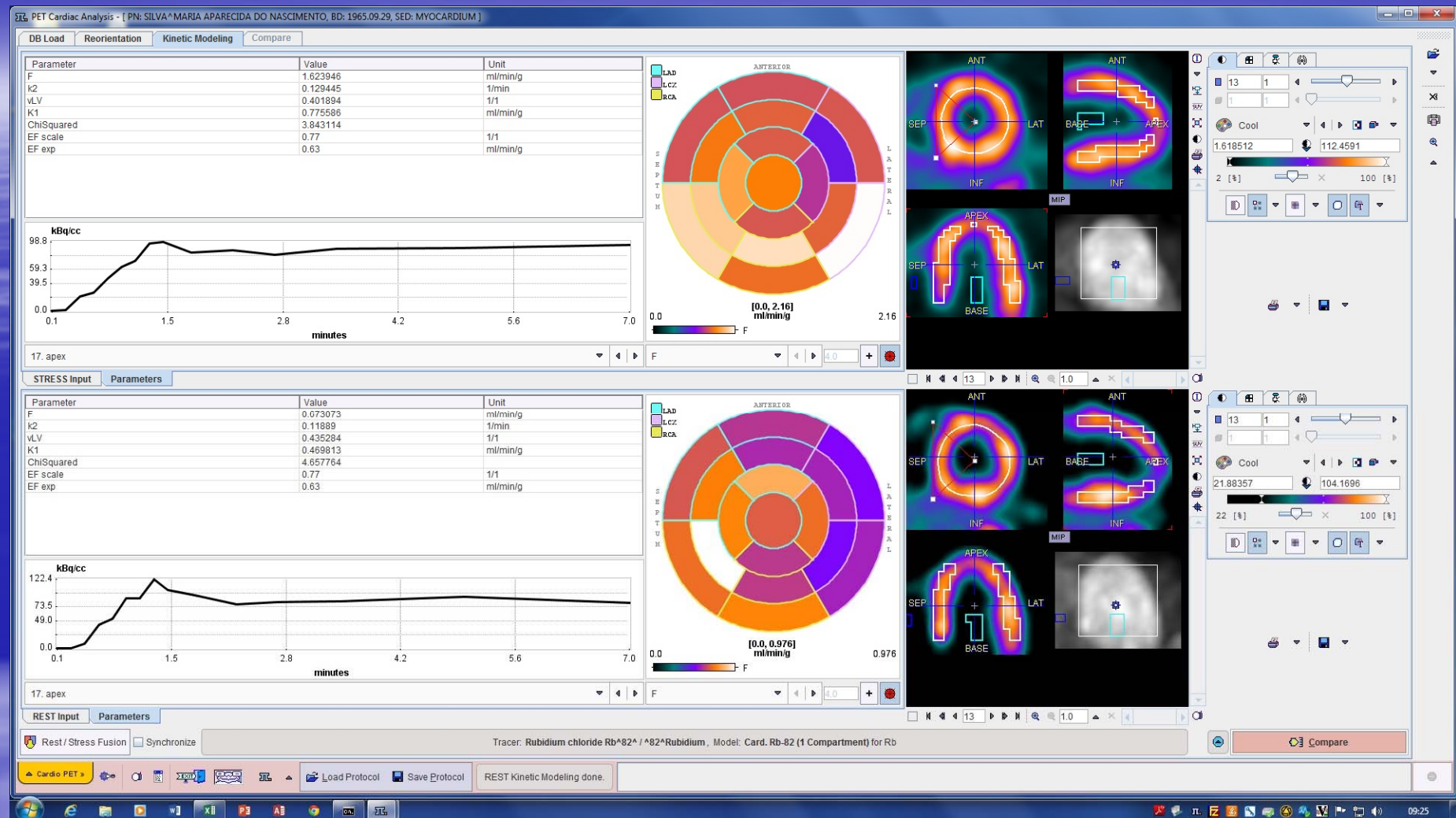


MANS NL

Rb-82 PET/CT



MANS NL



Coronary Flow Reserve (CFR) Summary

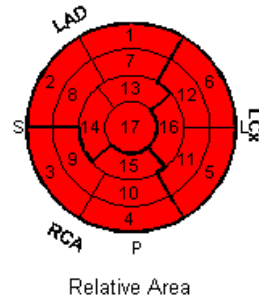


Processed with
FlowQuant®
Version: V2.4 (2013)

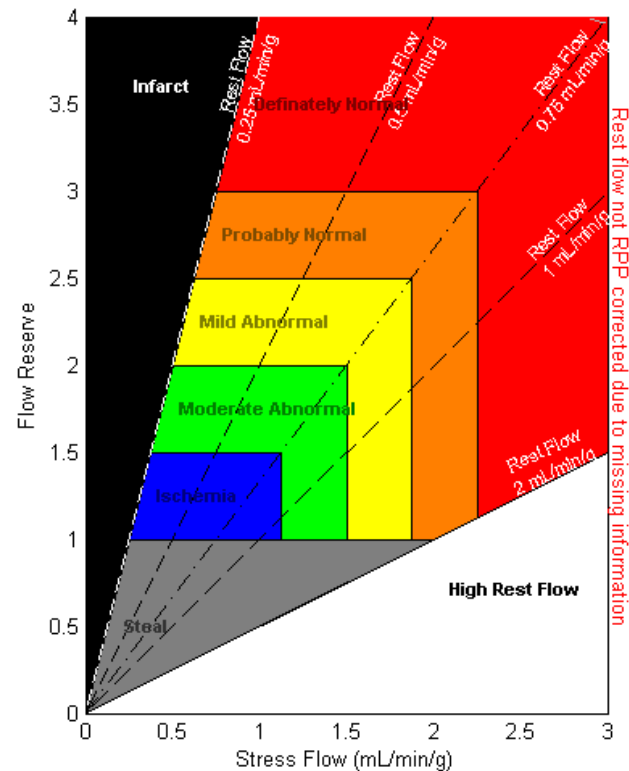
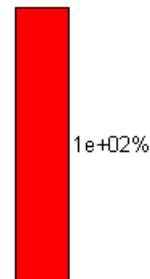
Exam Type: Rubidium Flow
Kinetic Model: Rubidium One-Compartment 2K Constant DV
Processing Date: 28-May-2013

	○ LV	◇ LAD	□ LCX	△ RCA
Rest (mL/min/g) (unadjusted)	0.75	0.77	0.61	0.88
Stress (mL/min/g)	3.81	3.96	3.03	4.32
Reserve	5.13	5.33	4.96	4.94

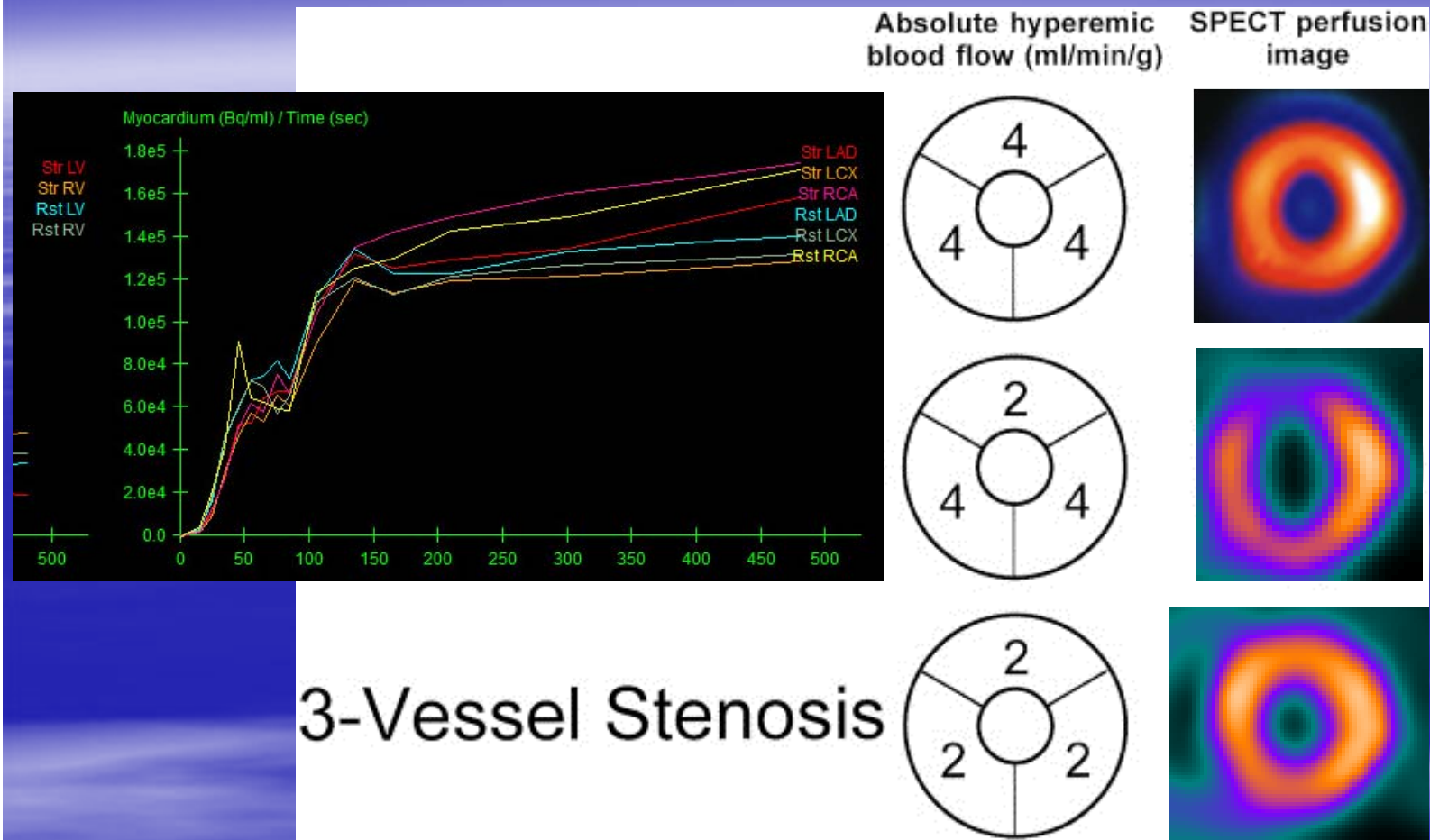
Regional Distribution



Relative Area



Perfusão Miocárdica PET



SPECT

Triarterial com isquemia balanceada (redução homogênea na reserva de fluxo nas 3 cor. maiores que apresentam lesões obstrutivas)

Ao estresse não há redução seg ou regional na captação do RF (Perf Relativa)

RESERVA CORONÁRIA

É a habilidade/capacidade de aumentar o fluxo sanguíneo coronário em resposta à demanda metabólica

É necessário Lesão cor > 80% para causar isquemia em Repouso*

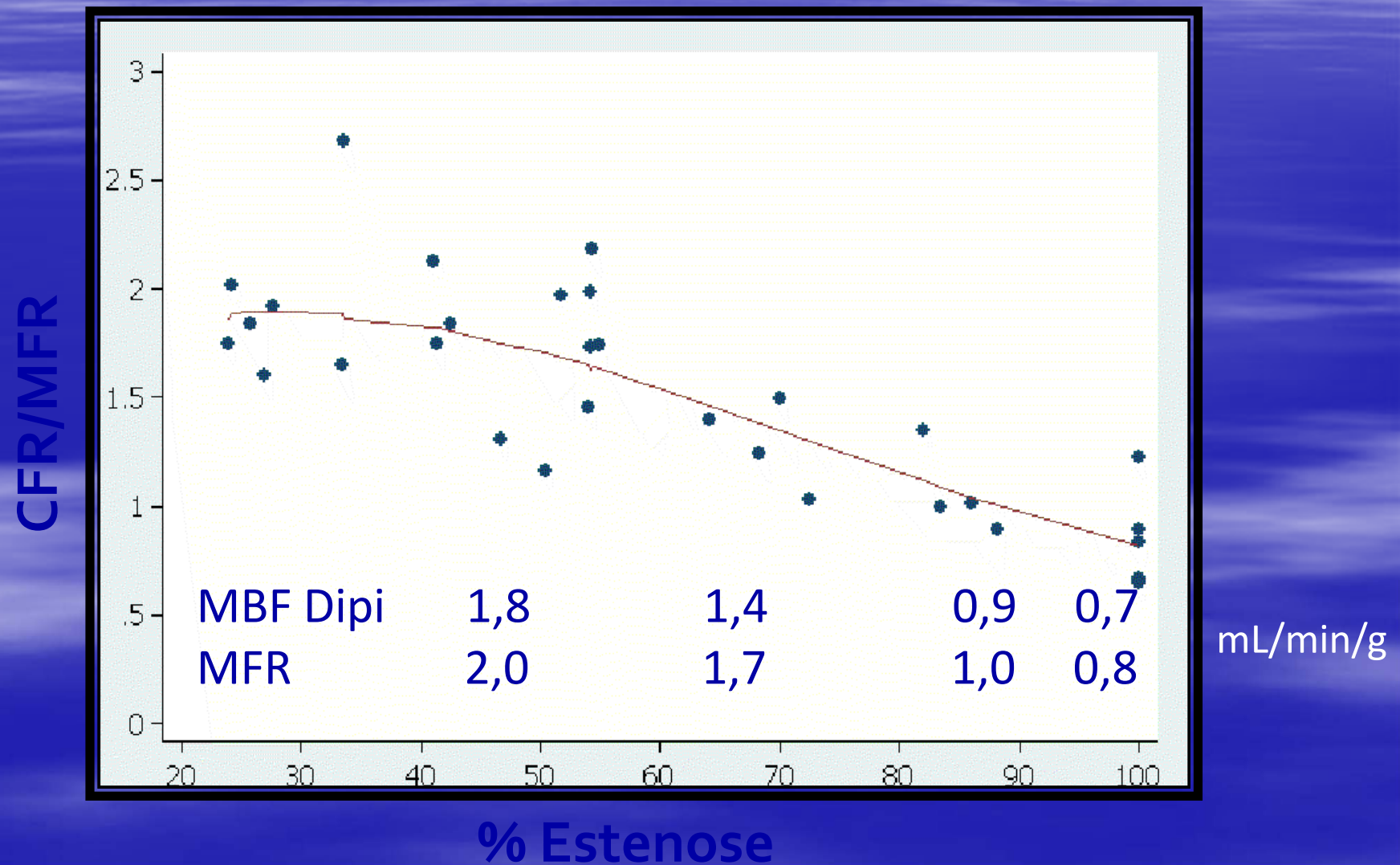


A Reserva Coronária está diminuída quando a estenose cor é > 40-50%

Apesar da dilatação arteriolar máxima, o fluxo sang não aumenta suficientemente para atender as necessidades metabólicas

Relação entre Estenose Coronária e Reserva de Vasodilatação Coronária(CFR/MFR)

Redução progressiva do MBF com dipiridamol e da Reserva do fluxo(MFR) com o aumento da Severidade da estenose coronária



Perfusão Miocárdica Rb-82

Prognóstico

Altamente preditor de Risco

Preditor Independente de RISCO Morte súbita e eventos cardíacos

Rb-82 PET NORMAL

Taxa Anual de Eventos Maiores muito baixa

< 0,09 % /ano *

*Chow et al JNuclMed 2005

< 0,4%/ano**

** Yoshinaga et al JACC 2006

**Imagens de Perfusão Miocárdica
+
Reserva de Fluxo Miocárdico(MFR)**

Período Livre de eventos > 3 anos

***Pts com DAC conhecida ou suspeita**

Ziad MC et al JACC 2011;58:740-8
CurrCardiolRep 2013

PET/CT Rb-82

Fluxo Sanguíneo Miocárdico

MBF

Quantificação Absoluta

Da quantidade de sangue que está suprindo cada região do miocárdio
X **Perfusão Relativa**

Valores Normais

mL/min/g

MBF Repouso

MBF Estresse

MFR(Reserva)

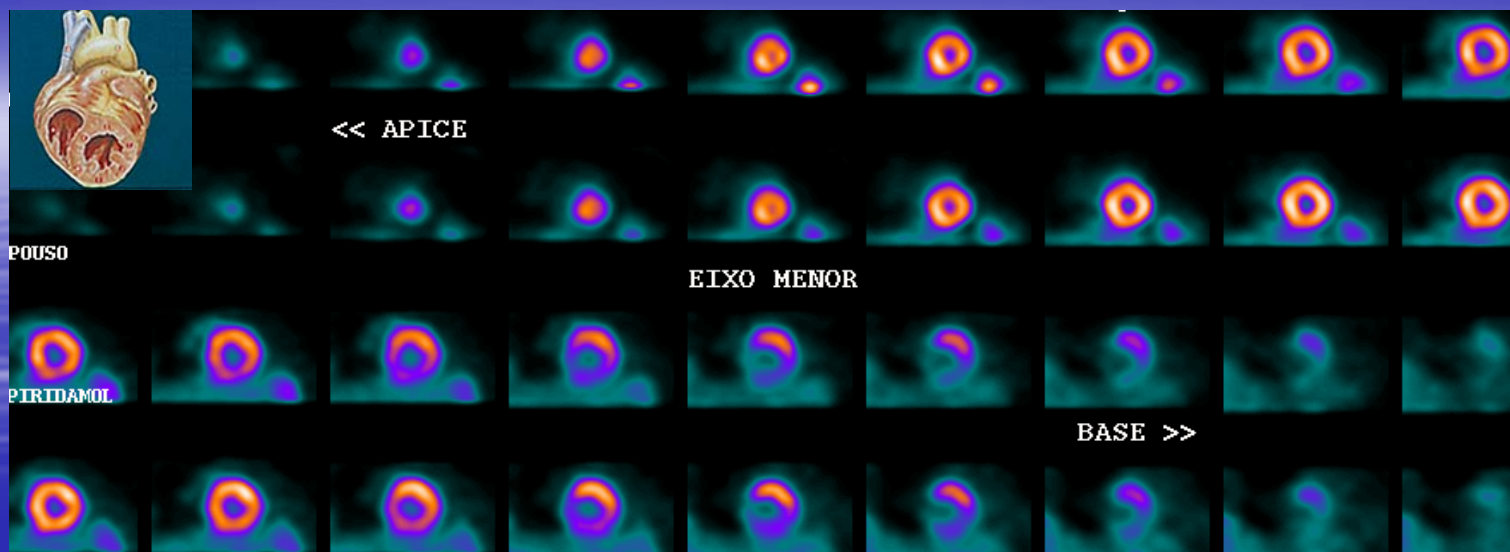
≤ 1

> 2

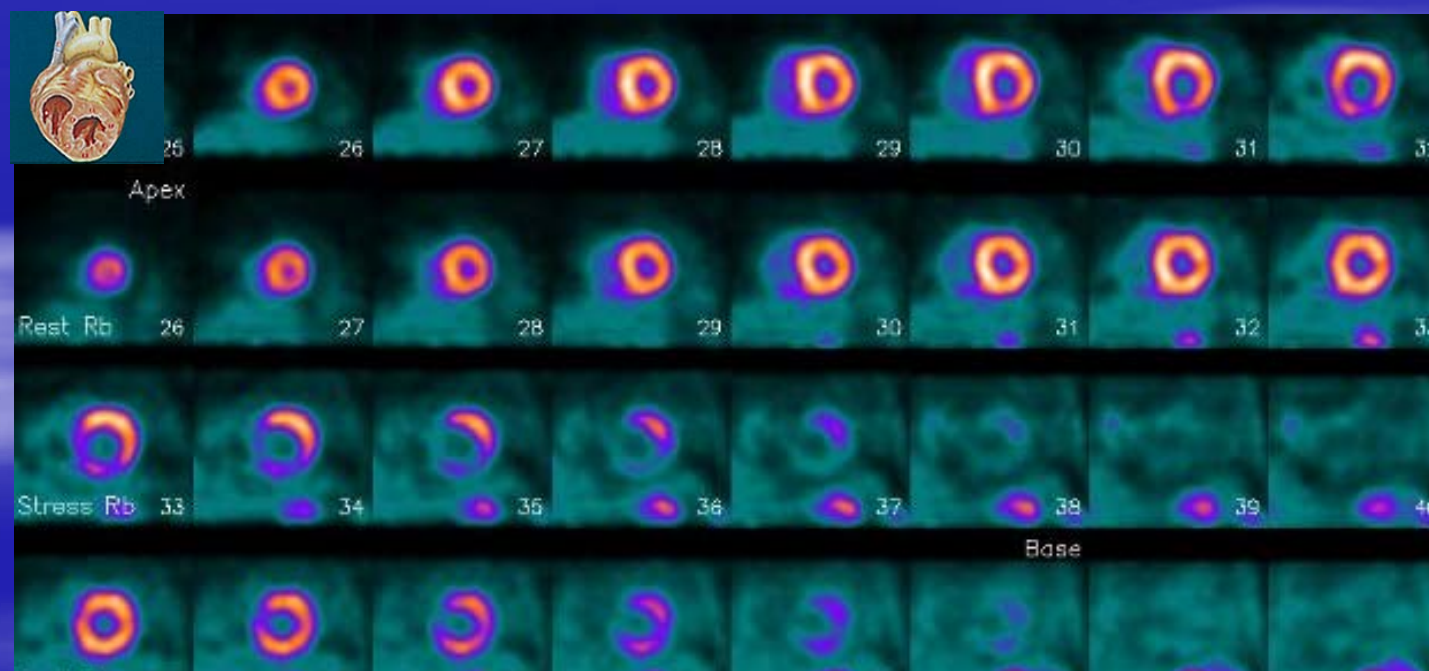
> 2

Softwares de quantificação Flow Quant Cedars Sinai PMod

MFR



MIBI
SPECT



Rb-82
PET/CT

Quantificação absoluta do FSM(ml/g/min) Reserva de Fluxo (Coronariana)

A queda na RC deve-se a estreitamento de arts epicárdicas ou na ausência de DAC detectável angiograficamente, pode refletir disfunção da microcirculação cor.

Benefícios da quantificação/aplicações

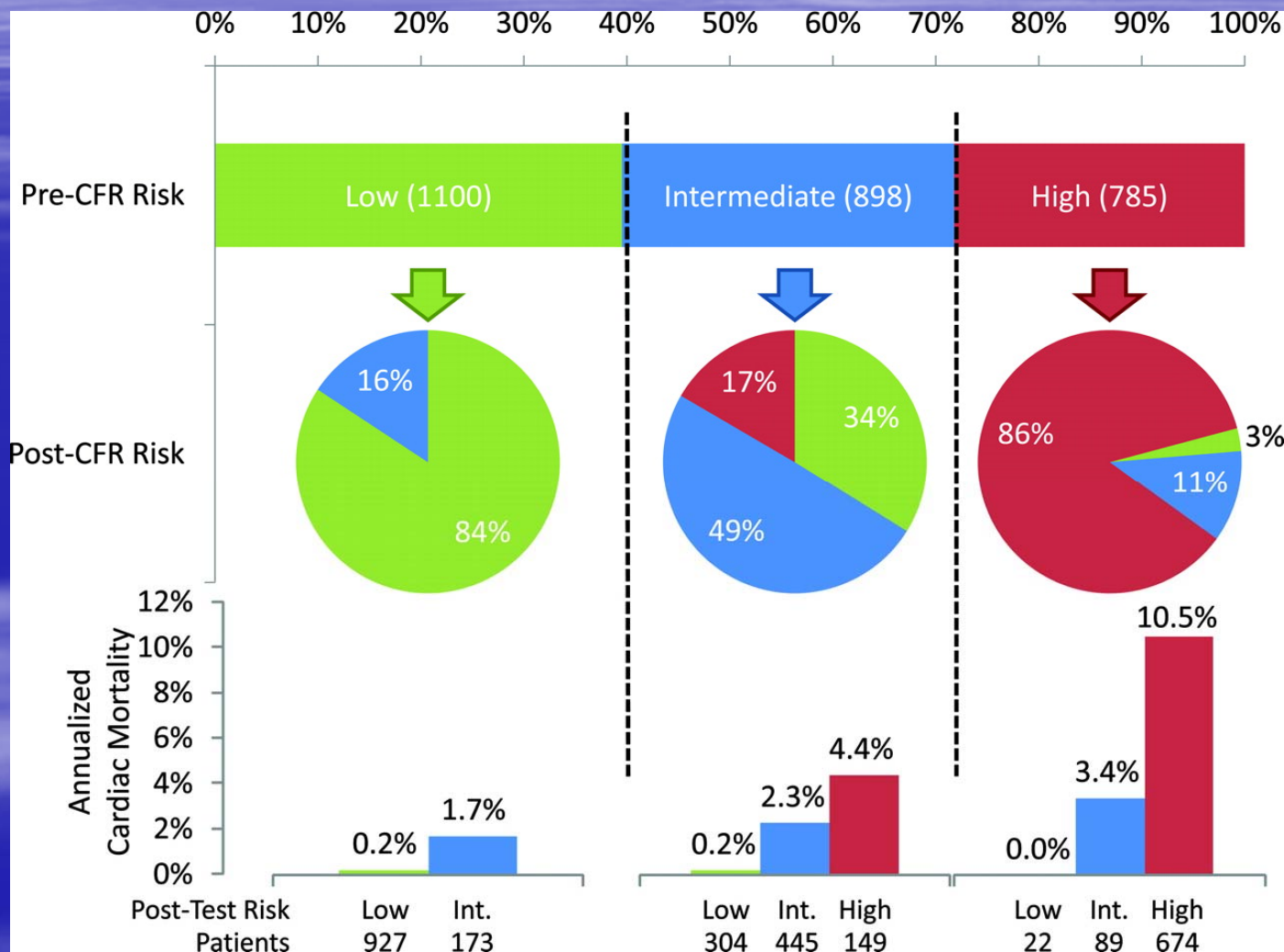
- O significado funcional de estenoses cor pode ser diretamente avaliado
- **Investigação de disfunção microvascular** na aterosclerose inicial e em doença microvascular não aterosclerótica associada com cardiomiopatias primárias e secundárias
- **Detecção de Dça multiarterial ou lesão de tronco** que podem produzir isquemia balanceada(aprox 13% de pts com lesões sign de tronco CE podem ter SPECT Normal)
- **Avaliar objetivamente os efeitos de intervenções medicamentosas(trato clínico)** ou procedimentos Intervencionistas

Melhora o Diagnóstico de Isquemia Miocárdica

Reclassificação do RISCO

“Improved cardiac Risk Assessment with Noninvasive Measures of Coronary Flow Reserve(CFR)”

Murthy et al, Circulation 2011; 124:2215-2224



48 anos , Fem

DAC Triarterial em Trato Clínico desde 2007

DM, HAS, Obesidade

HDL 25 mg/dL LDL 66 mg/dL

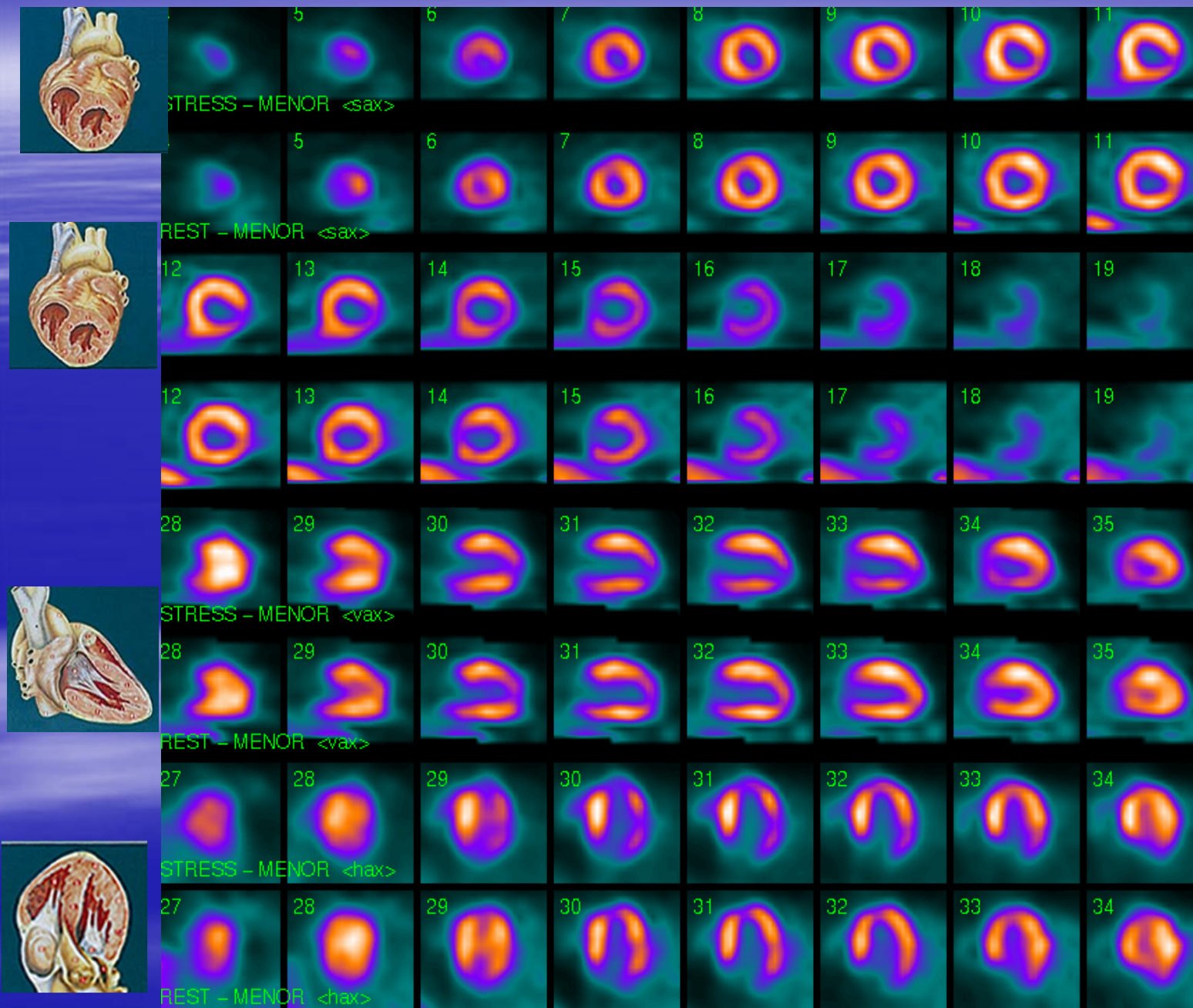
FEVE Normal

- Dor precordial em fisgada

FFS

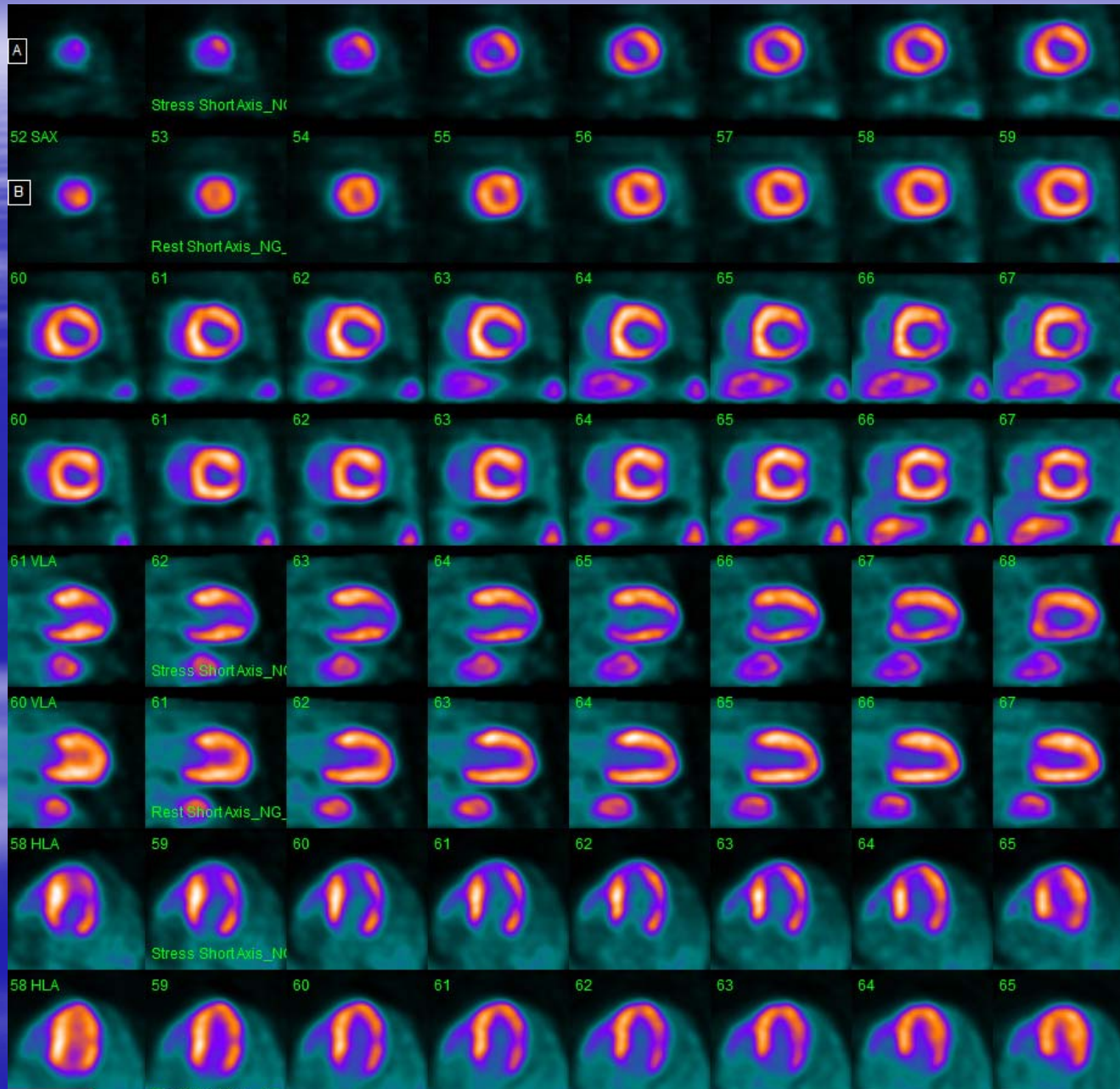
Perf Mioc MIBI-99mTc

Isquemia
Inf(ap)
IL(M,B)



FFS

Perf Mioc Rb-82 PET/CT



Isquemia

Inf (ap)

IL(M,B)

Apical

Anterior(A)

Sep(A)

AS(M)

FFS

Pat ID	3069507		
Sex	FEMALE		
Limits	--		
TID	1.21		
Lng:Hrt	--		
SSS	16	SRS 5	SDS 11
SS%	24	SR% 7	SD% 16

Rb-82 PET/CT

Imagens Perfusão

Isquemia mais extensa que a mostrada ao MIBI-Tc99m

Quantificação Absoluta MBF MFR

Reserva Coronária

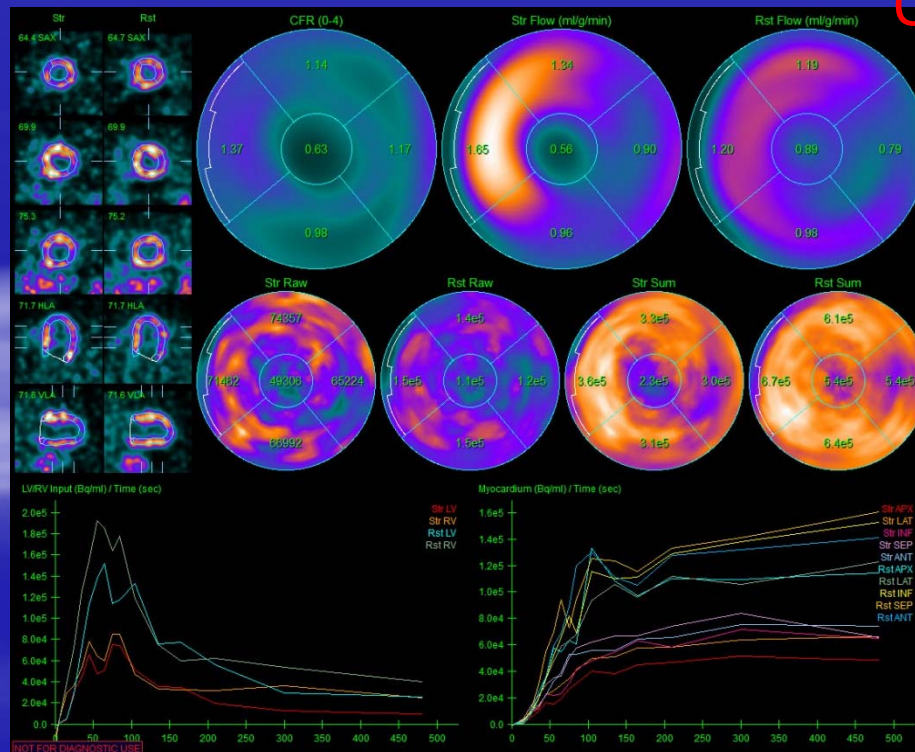
CFR mL/min/g

LAD 1,03

LCX 1,19

RCA 1,09

Global 1,08



“Improved cardiac Risk Assessment with Noninvasive Measures of
Coronary Flow Reserve(CFR)”

Murthy et al, Circulation 2011; 124:2215-2224

A adição da CFR a variáveis clínicas, FEVE Rep,
Reserva de FEVE, extensão da fibrose miocárdica,
extensão da isquemia miocárdica

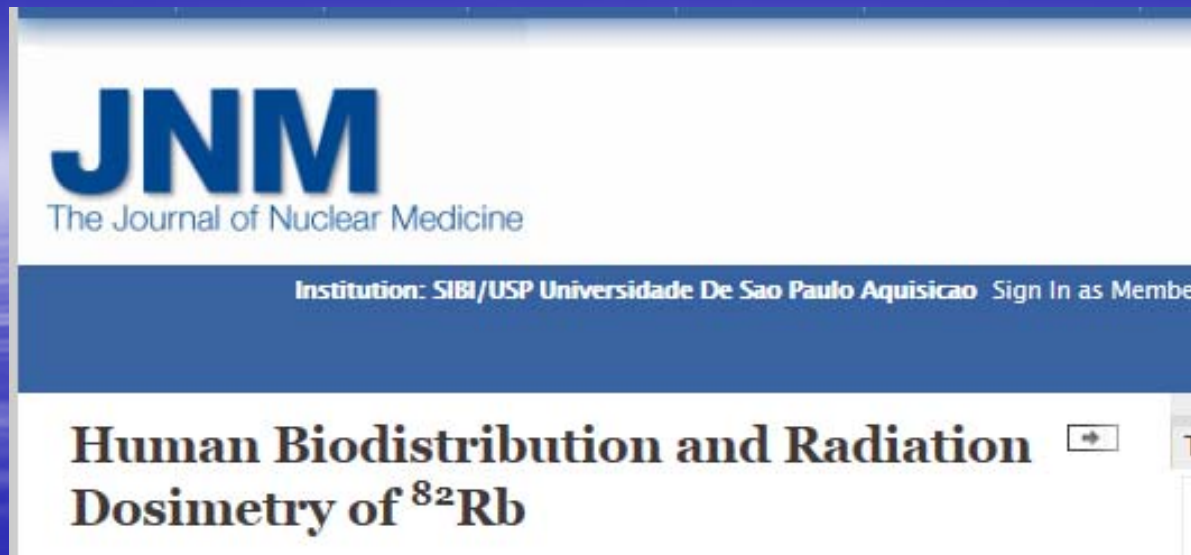
Resultou em correta reclassificação de aproximadamente
1/3 de todos os Pacientes com Risco Intermediário

A melhor estimativa de Risco obtida com CFR pode alterar a conduta

- Melhorar fatores de risco, encaminhar para revascularização

A Avaliação quantitativa não-invasiva da Função Vasodilatadora Coronariana
(Reserva Coronariana) com PET é um preditor poderoso e independente
de Mortalidade Cardíaca em pts com DAC conhecida ou suspeita e
fornece estratificação de risco incremental significativa sobre variáveis
Clínicas e da Imagem de Perfusão Miocárdica(gated-PET)

Estas medidas quantitativas podem ser obtidas sem custo adicional, tempo
de imagem ou exposição à radiação



JNuclMed 2010; 51:1592-99

Rb-82 Estresse e Repouso
+ CT

Baixa Exposição à Radiação : Dose efetiva 3,7 mSv

Exposição BG natural : 3,1 mSv