# CORONAROPATHIES ET SCINTIGRAPHIE DE PERFUSION MYOCARDIQUE

مصحة أثينا
Clinique ATHENA
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JOURNÉE THÉMATIQUE
D'ATHÉNA

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# PROTOCOLE REPOS/EFFORT

Repos
± 2 TNT SL

3,7 MBq/kg
MIBI/TF
ou
0,5 MBq/kg
Tl201

5' (CZT)/20' repos
synchro ECG ± CA
Procubitus (decubitus)
RPF/OSEM BTW 0,4/5

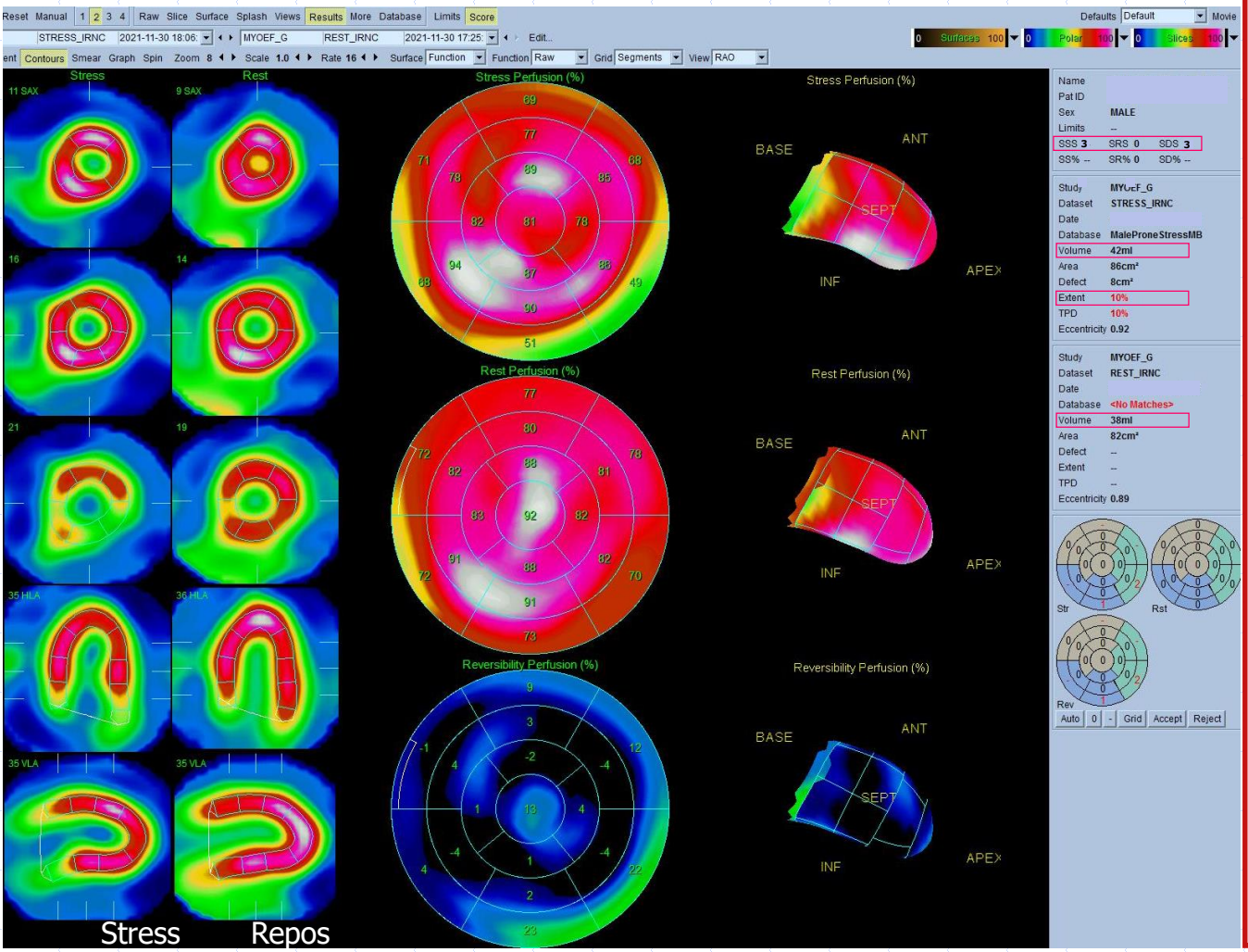
Stress mixte :
fc > 85% (220-âge)
dipyridamole 0,56-0,75 mg/kg
Sur 4 minutes
si CI: Regadenoson 0,4 mg
ou dobutamine

11 MBq/kg MIBI/TF acmé stress
Ou
1,5 MBq/kg Tl201

5' (CZT) / 20' repos
synchro ECG ± CA
Procubitus (decubitus)
RPF/OSEM BTW 0,4/7

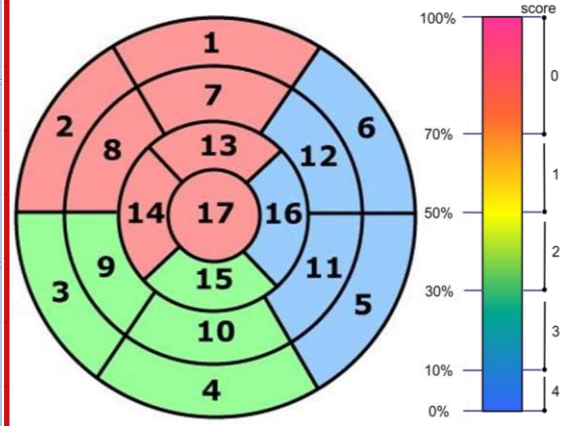
Dosimétrie: 7 mSv = 3 ans en France (260 mSv/an à Ramsar) = 1/3 CT injecté en moyenne

# Quantitative Perfusion SPECT (QPS)




## 1- Quantification relative (QPS)

Scores sommés: ischémie/nécrose
% Surface VG anormale




## 2- Dilatation VG (QPS)

**DIT**: $V_{stress}/V_{repos}$(non gated) > 1,4

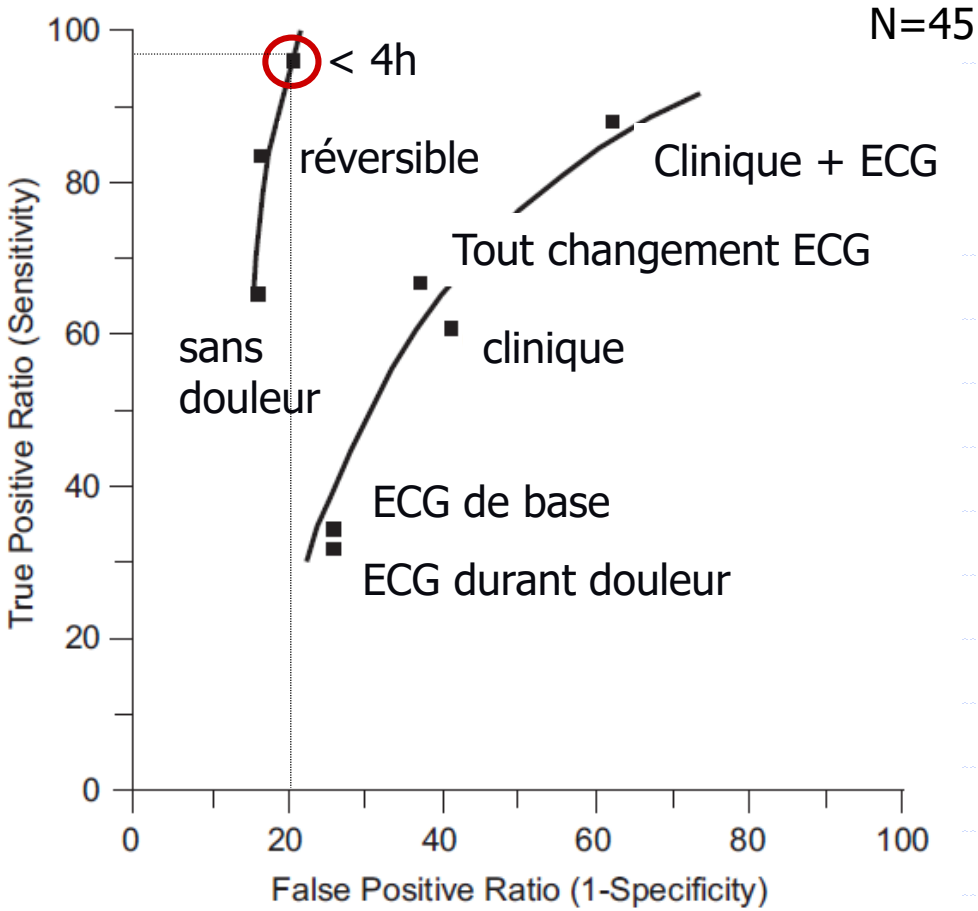
**Remodelage** VG : V > 63 mL/m²
soit environ 120 mL (H; 1,9 m²)
ou 100 (F; 1,6 m²) mL

A Ghatak Semin Nucl Med 2013; 43:71-81 – MD Duca J Nucl Cardiol 1999; 6:570-6
T Sharir J Nucl Cardiol 2018;25:738-741 – M Alama J Nucl Cardiol 2018;25:724-37

# SCA & SPECT MYOCARDIQUE DE REPOS

- ECG : 40-65% N
- Troponine US : N si ischémie sans nécrose
  - Se (cTn T/I) < 40% si angor instable*
- TSM de repos :
  - Plus précoce / ECG
  - Se >> Tropo 24h
  - Se = VPN = 99%
  - Sp = 73 %
  - < 3h de la douleur
  - FN : spasme coronaire

12 études
1979-2007
4210 patients



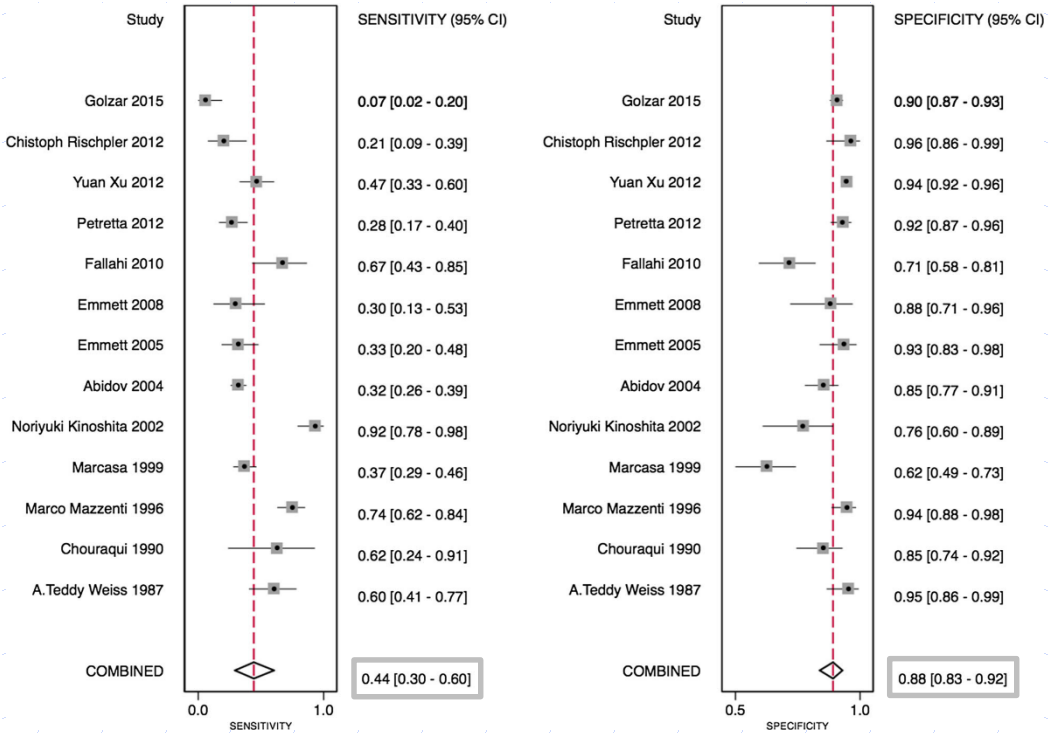

A. Ghatak. Semin NuclMed 2013 43:71-81 – *MD Duca. J Nucl Cardiol 1999;6(6) – L Biliodeau JACC 1991; 18

# Dilatation ischémique transitoire

- DEF = $V_{stress}$ / $V_{repos}$ > 1,12-1,38 (sans synchro)

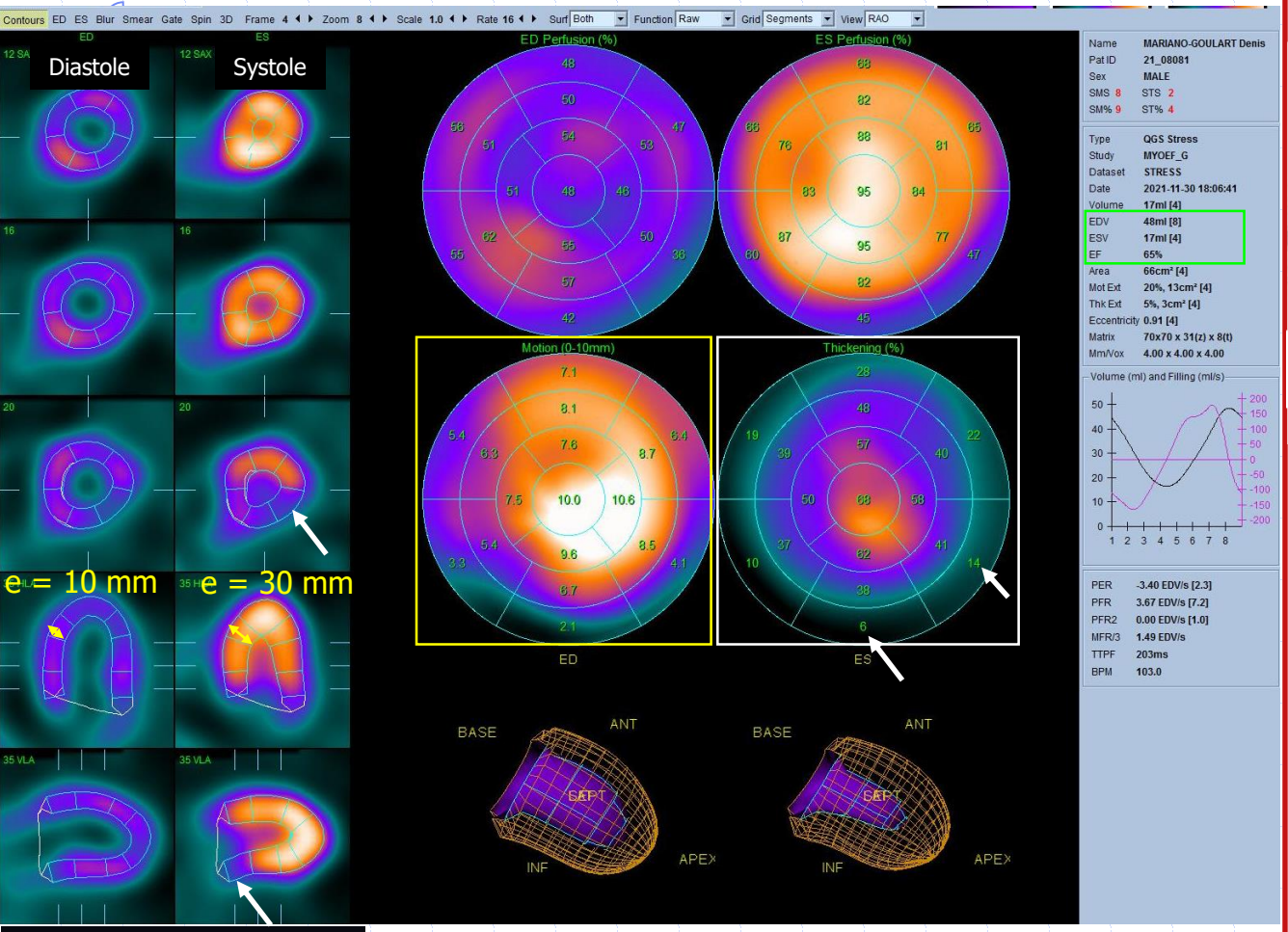
- Cause :
  - ischémie sous
    -endocardique diffuse

- Sp = 88 % pour maladie coronaire diffuse même si perfusion homogène (DNID)




T Sharir J Nucl Cardiol 2018;25:738-741 – M Alama J Nucl Cardiol 2018;25:724-37

# Quantitative Gated SPECT (QGS)

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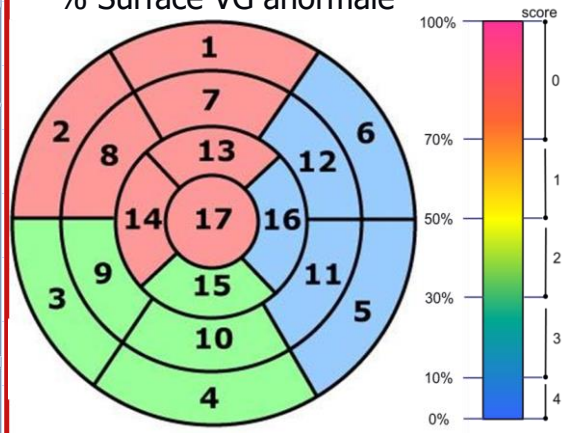


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**DIT**: $V_{stress}/V_{repos}$(non gated) > 1,4

**Remodelage** VG : V > 63 mL/m²

soit environ 120 (H) ou 100 (F) mL

## 3- Cinétique segmentaire (QGS)

**Sidération** (au stress): Ø<20%,3T

**Hibernation** (au repos et stress)

## 4- Artefacts d'atténuation (QGS)

Hypo S/R à ES normal > AC par CT

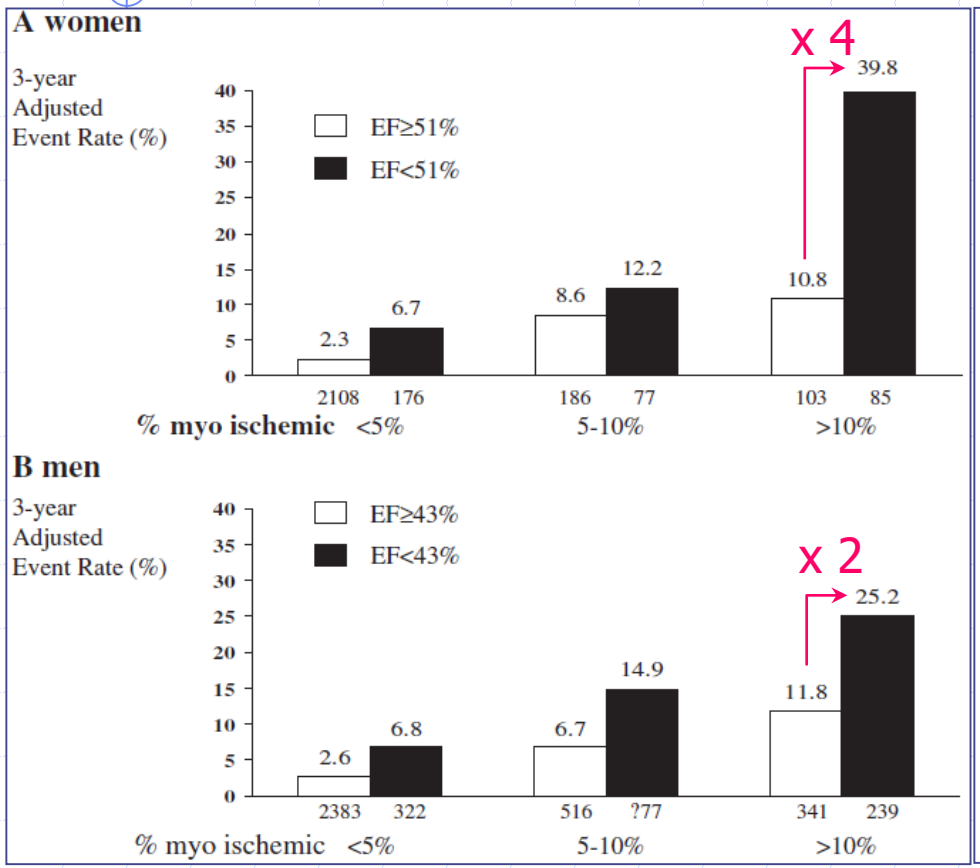
## 5- Pronostic CV à 3 ans (QGS)

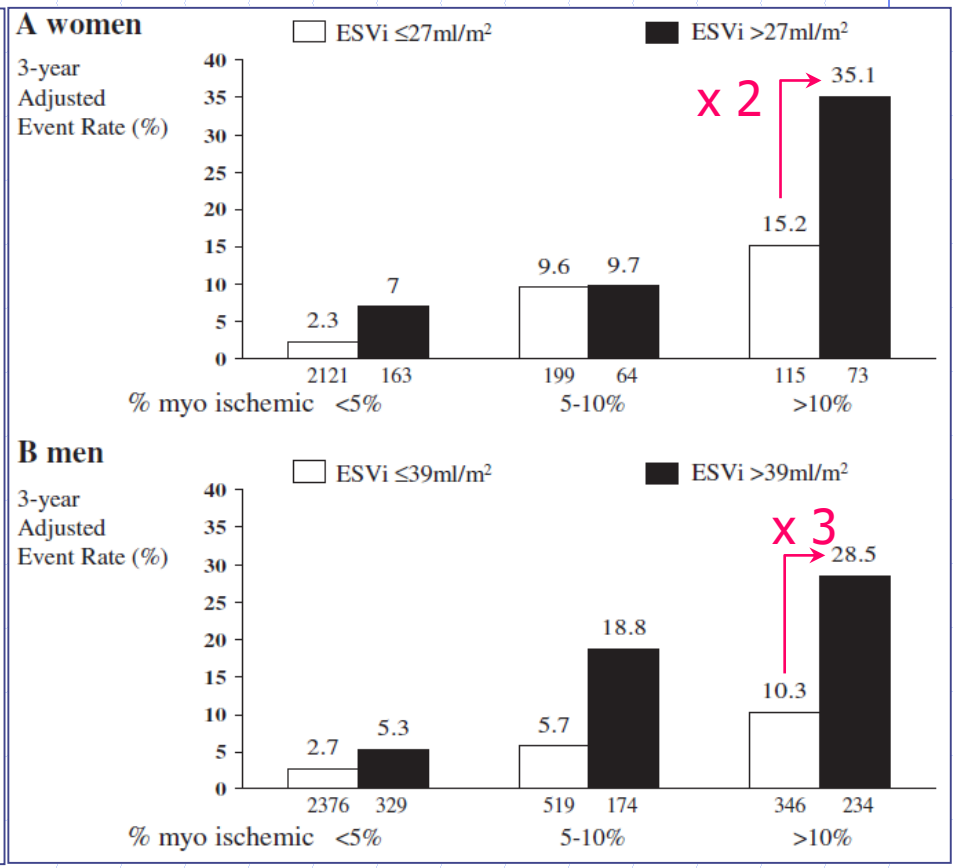
FE < 51 (F) ou 43% (H)

ESV > 27 (F) ; 39 (H) mL/m² (≈ 50;75 mL)

JR Galt. IEEE Trans Med Imag. 1990; 9 ; G Germano. JACC 1997;30 ;
T. Sharir et al. Circulation 1999;100 ; J Nucl cardiol 2006;13(4) et J Nucl cardiol 2018;25; Emmet JACC 2002;39;
S Karimi-Ashtiani J Nucl Med 2012;53; Wei Yang J Nucl Cardiol 2018;25

# QGS® et pronostic à 3 ans



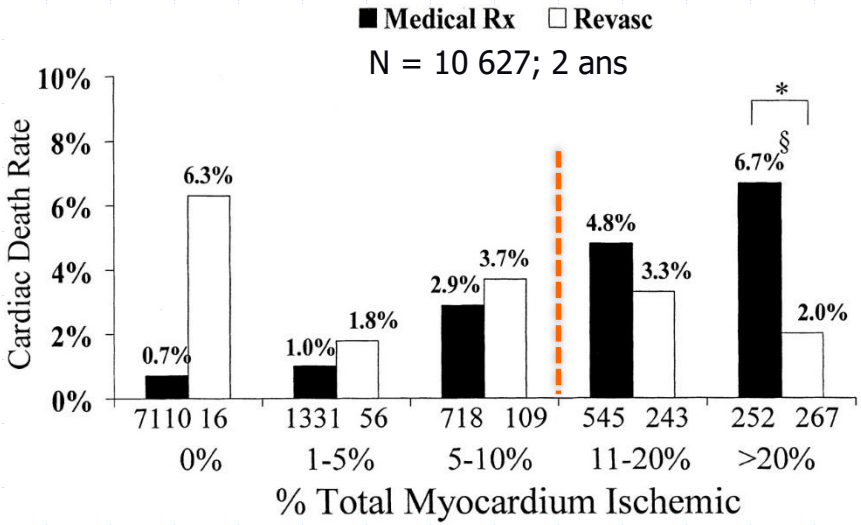

6713 patients = 2735 femmes et 3978 hommes,
suivi 35 ± 14 mois pour IDM ou mort cardiaque

T. Sharir et al. Circulation 1999;100:1035-42 et J Nucl cardiol 2006;13(4):495-506

# Se/Sp ≈ 90/80% et CAT après SPECT

| *Bateman 2005: N=116 CA*<br>*Mowatt: N=3032 (méta)* | | **BMI < 30** | **BMI > 30** | **Tous patients** | **ECG d'effort** |
|---|---|---|---|---|---|
| **Sensibilité (%)** | NC | 90 | 87 | 88 | 64 |
| | **CA** | 90 | 82 | 86 | |
| **Spécificité (%)** | NC | 64 | 41 | 50 | 77 |
| | **CA** | 82 | 76 | 79 | |

| *Benkiran 2015 : N=70*<br>*(suivi 2 ans, 13 CA)* | **TSM** | **+ ES** | **+ CT** |
|---|---|---|---|
| **Sensibilité %** | 77 | 69 | 67 |
| **Spécificité %** | 60 | 98 | 81 |
| **Exactitude %** | 63 | 93 | 79 |




ISCHEMIA : coronariens « stables » sans IC ni IR ni sténose TC
Angioplastie délétère à 6 mois mais bénéfique sur l'angor et à 4 ans.

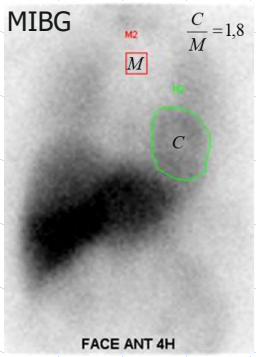
Hachamovitch et al. Circulation 2003; JM Links J Nucl Cardiol 2002;9:183-187-T.M. Bateman.Semin Nucl Med 2005;35:37-51-G. Mowatt. Health Technology Assessment 2004; 8(30):1-222; M. Benkiran Nucl Med Comm 2015; 36(1):69-77

# Pièges et astuces

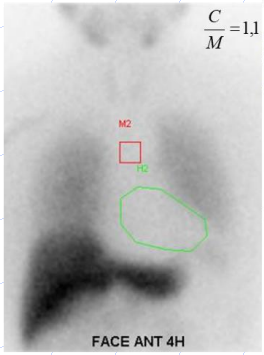
- FN (versus coronarographie). Pour les éviter :
  - Epreuve de stress maximale (mixte), TA, interprétation conjointe.
  - Protocole repos/stress (DIT, Gated S/R)
  - ES de stress et de repos (tri tronculaires: Se 20→50%)
  - Activité digestive : SPECT 5' après IV. Reprendre si besoin.
- FP
  - ≠ FP à coroscan ± coronarographie normaux : Spasme coronaire, coronaire intra-myocardique, CMPH, dysfonction microvasculaire (diabète:RC)
  - Atténuation et Mouvement diaph.: Exercice, SPECT rapide au Tc, Pro/Decubitus, ES, CA
  - Ischémies de stress (ou S/R) faussement positives : regarder l'échocardio…
    - SEPTAL : BBG si fc>100: persantine sans effort significatif
    - LATERAL : RAo et HTA (FP E/R sur septum épaissi)
    - APICAL : Takotsubo, IAo (sur HVG)
    - BASAL : IM ou prolapsus mitral ↑ si fc ↑ (tension sur muscles papillaires)
    - Antérolat/infseptal (2h/7h : muscles papillaires)
    - Infseptal/antéroseptal (7h/11h: HVD)
    - Diffus: CMPD (E/R sur EVP), séquellaire à M1 d'une angioplastie, maladies de surcharge (sarcoïdose, amylose)

# SPECT D'INNERVATION SYMPATHIQUE

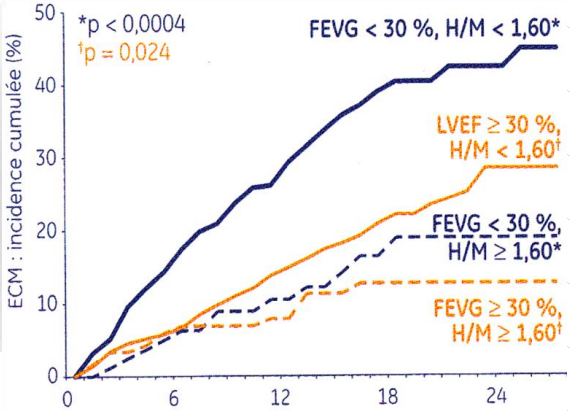
- Pronostic IC NYHA 4 / Indication DAI

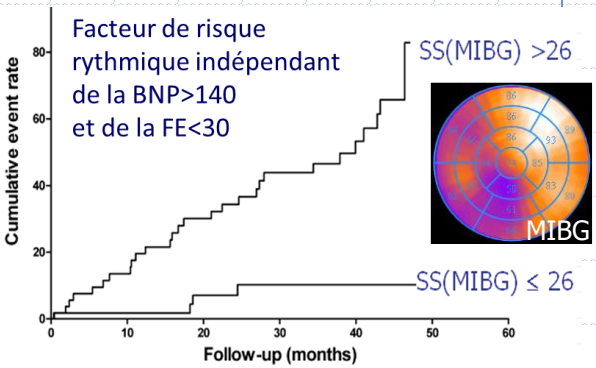



90% survie à 2 ans

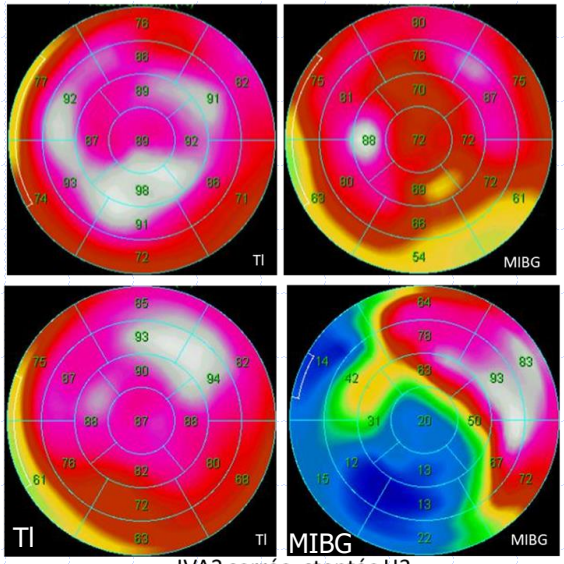



60% survie à 2 ans




CD3 subocclusé stentée H3, 80% / IVA2 + Mg1, stentées J3

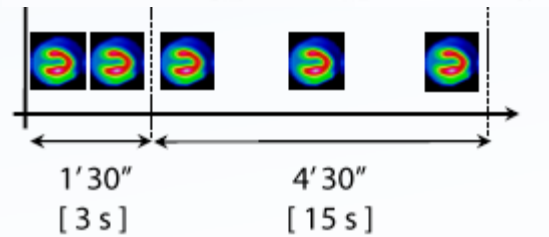


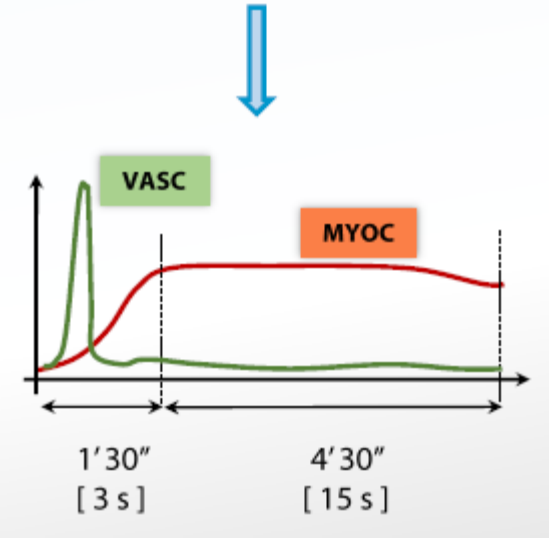

IVA2 serrée, stentée H3

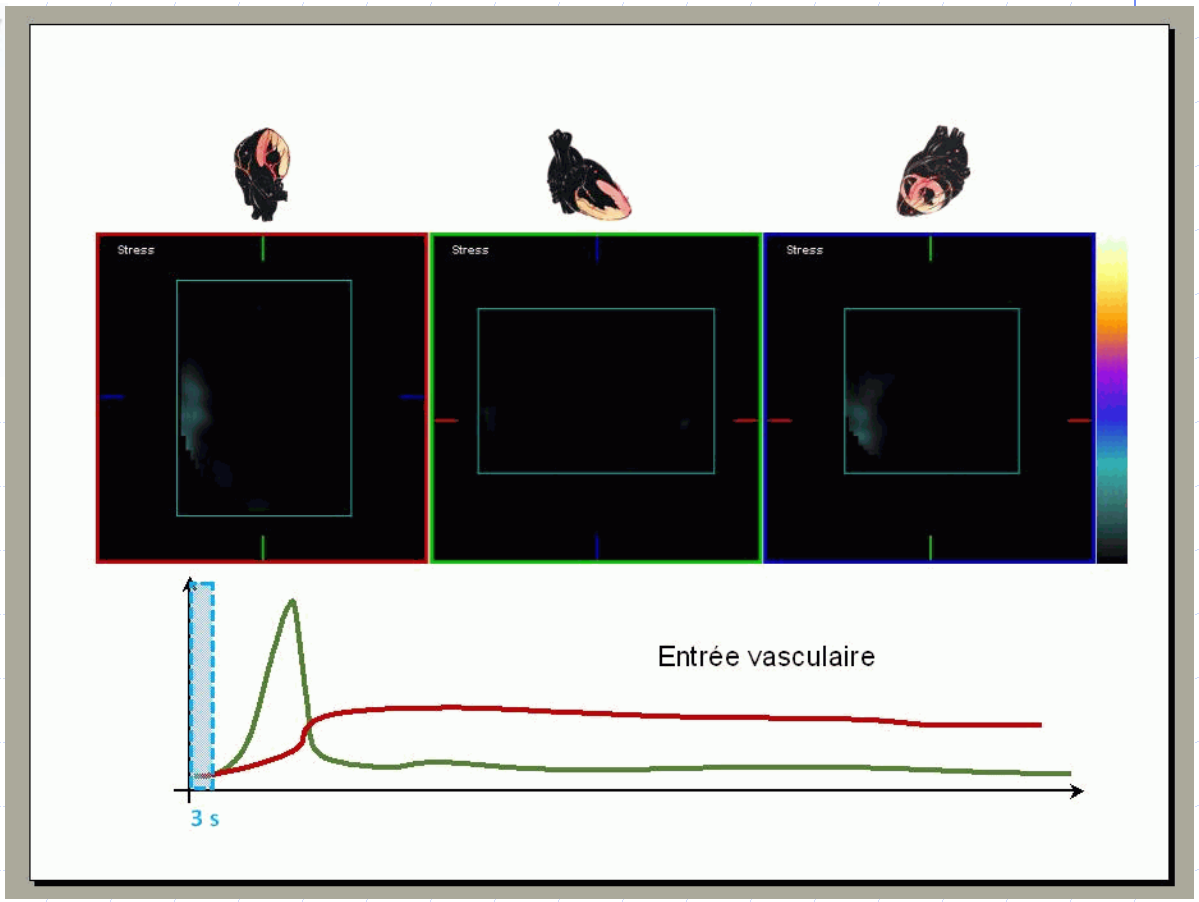
- Zones à risque/Gâchette
  - Viables avec recapture MIBG altérée

Admire HF (N=961) AF Jacobson et al. JACC 2010; 55(20) - MJ Boogers et al. JACC 2010; 55(24) - Bax et al. Circ Cardiovasc Imaging 2008 - E d'Estanques et al. J Nucl Cardiol 2017;24-C. Hédon, Nucl Med Comm 2018;26-F Vauchot J Nucl Cardiol 2018;25-JT Ortiz-Perez Eur Heart J 2007;28

# SPECT DYNAMIQUE (LIST MODE)



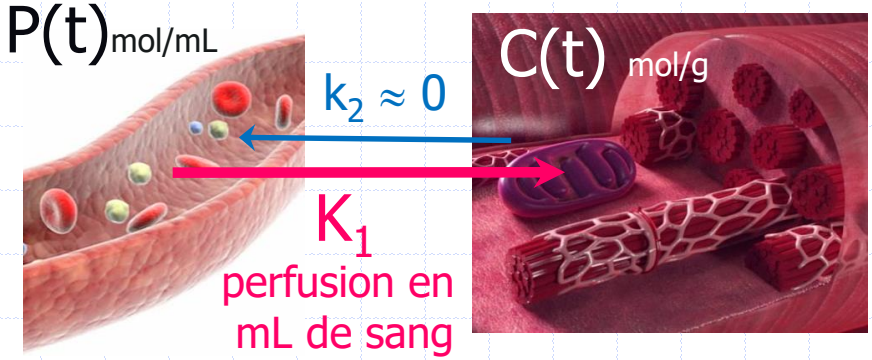

1 mCi Tc-TF — centrage

5 mCi Tc-TF — Repos List 5'

0,56 mg/kg DIP — 4'

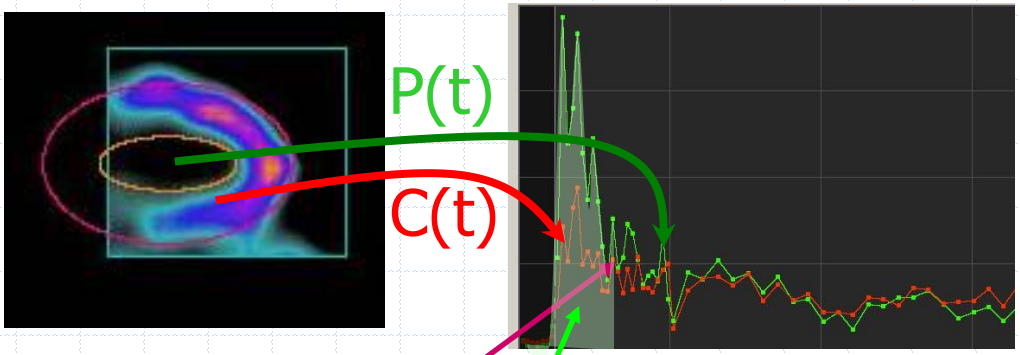
18 mCi Tc-TF — Stress List 5'

# RESERVE CORONAIRE

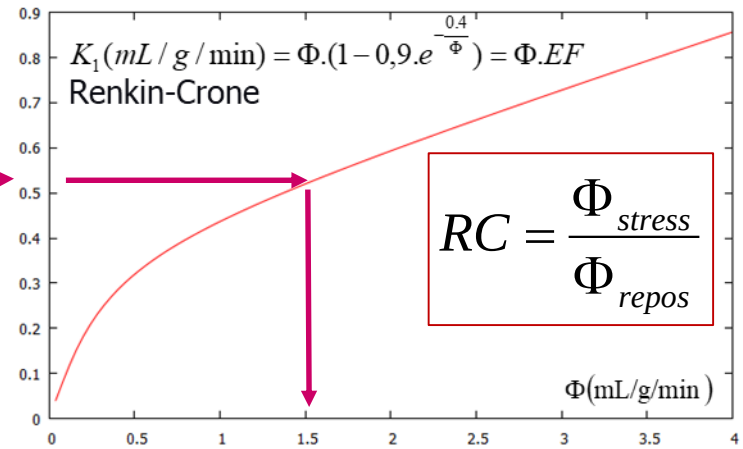



$$\frac{dC(t)}{dt} = K_1.P(t) \Rightarrow \int_0^t \frac{dC(t)}{dt}dt = K_1.\int_0^t P(t)dt$$

$$C(t) = K_1.\int_0^t P(t)dt$$



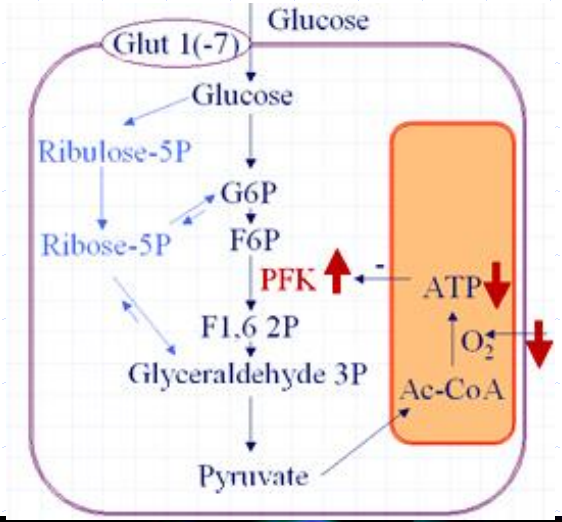

$$K_1 = \frac{C(t)}{ASC(t)} \approx \frac{\overline{C}_{Myoc\ plateau}}{ASC_{Pic\ vascu}}$$

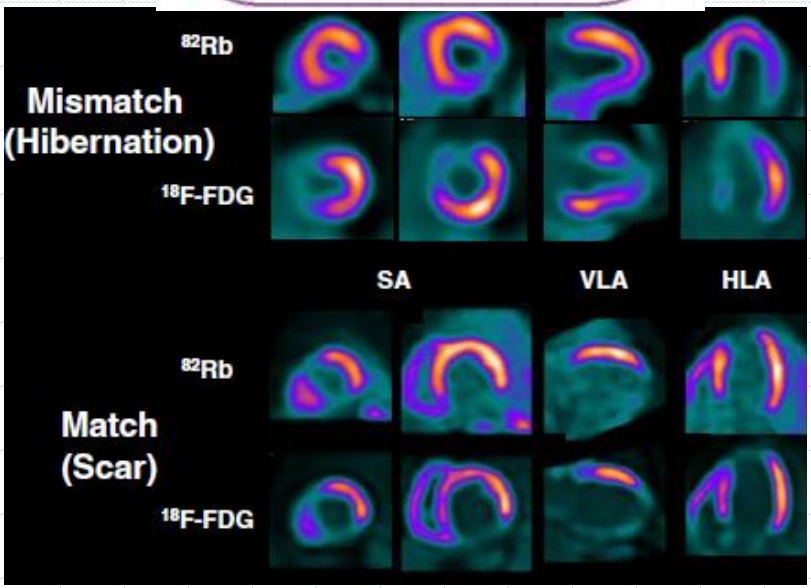


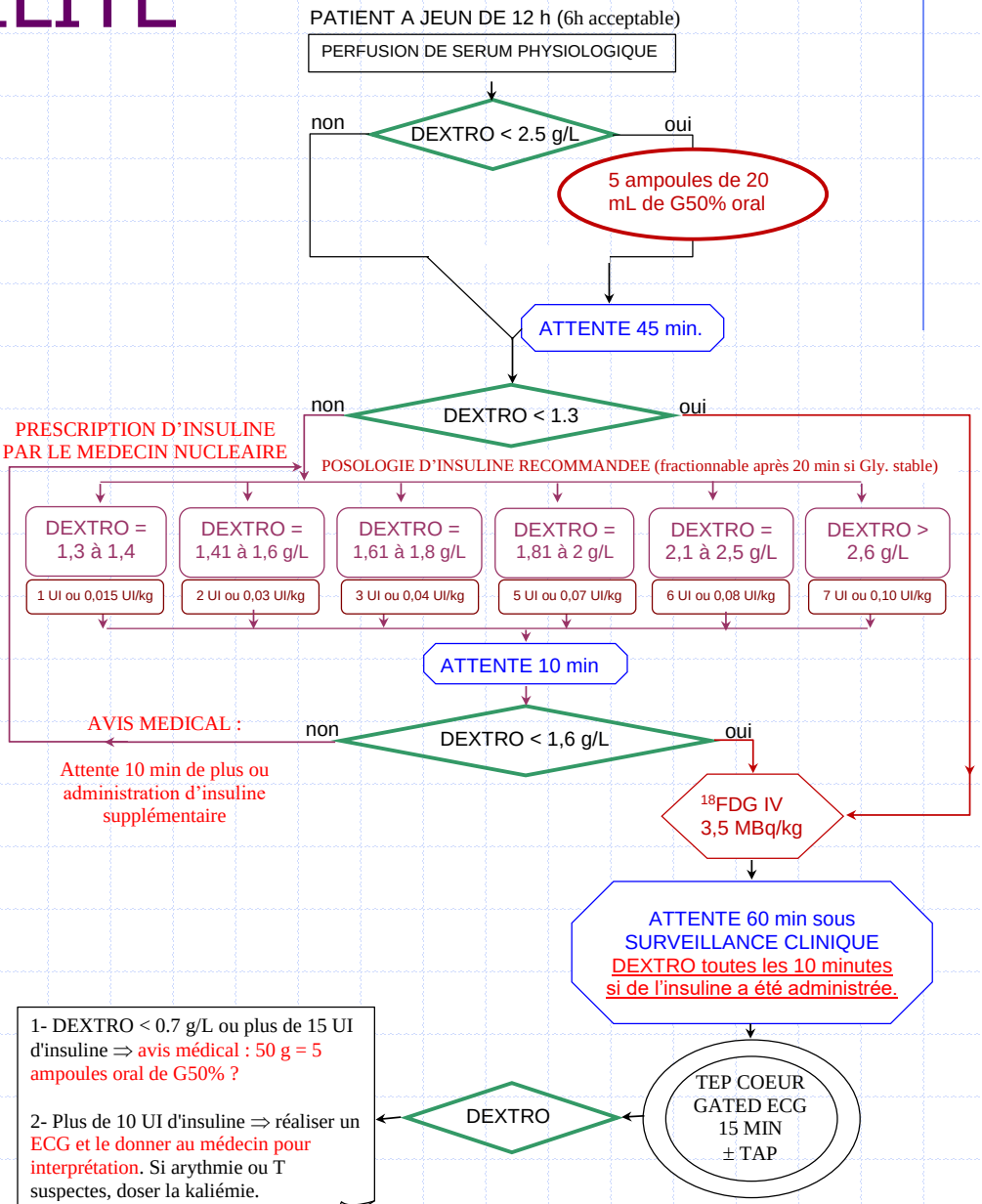

(correction EVP et contamination P→C)

JA Leppo Circ Res. 1989; 65:632-9

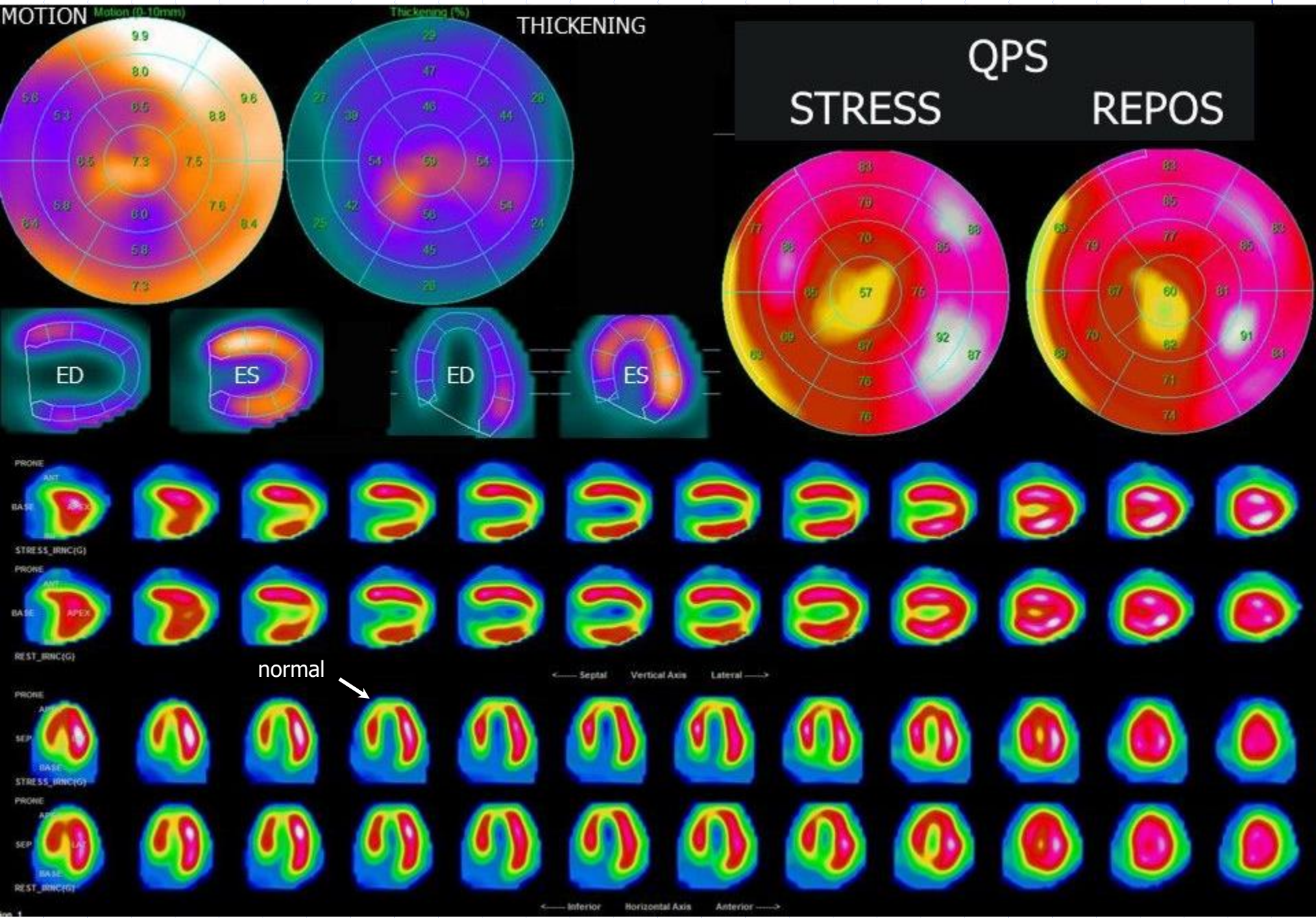
# TEP $^{18}$FDG DE VIABILITE MYOCARDIQUE

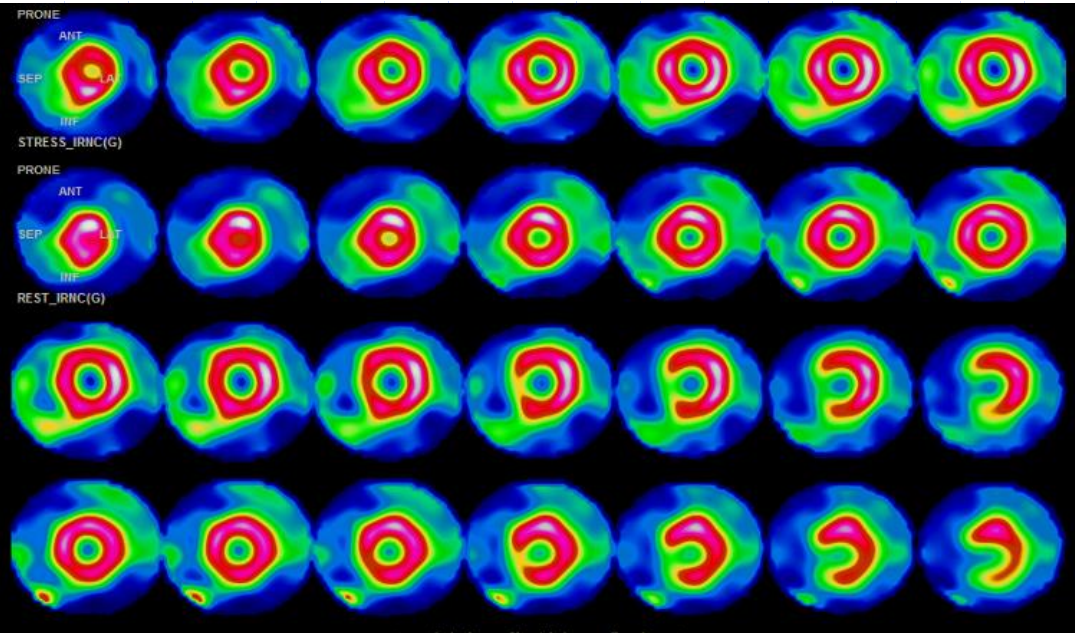


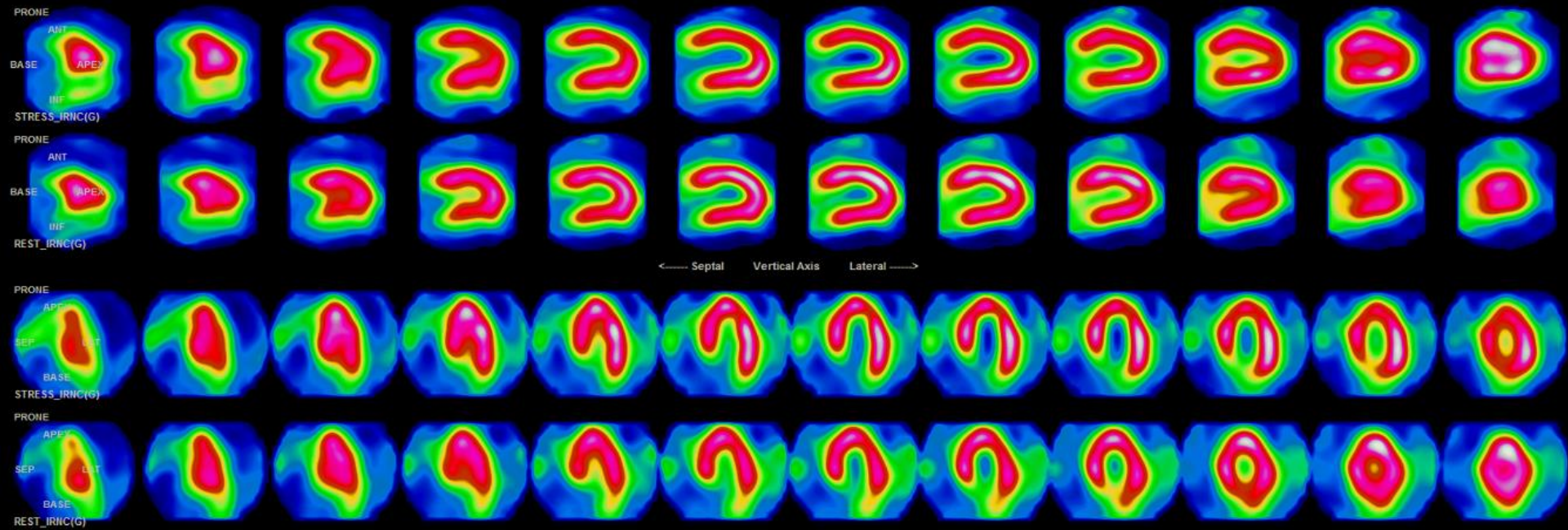

D. Mariano-Goulart. 30/11/2020. Réf. J Nucl Med 2013; 54(8): 1485-1507 et avis du Pr E Renard.

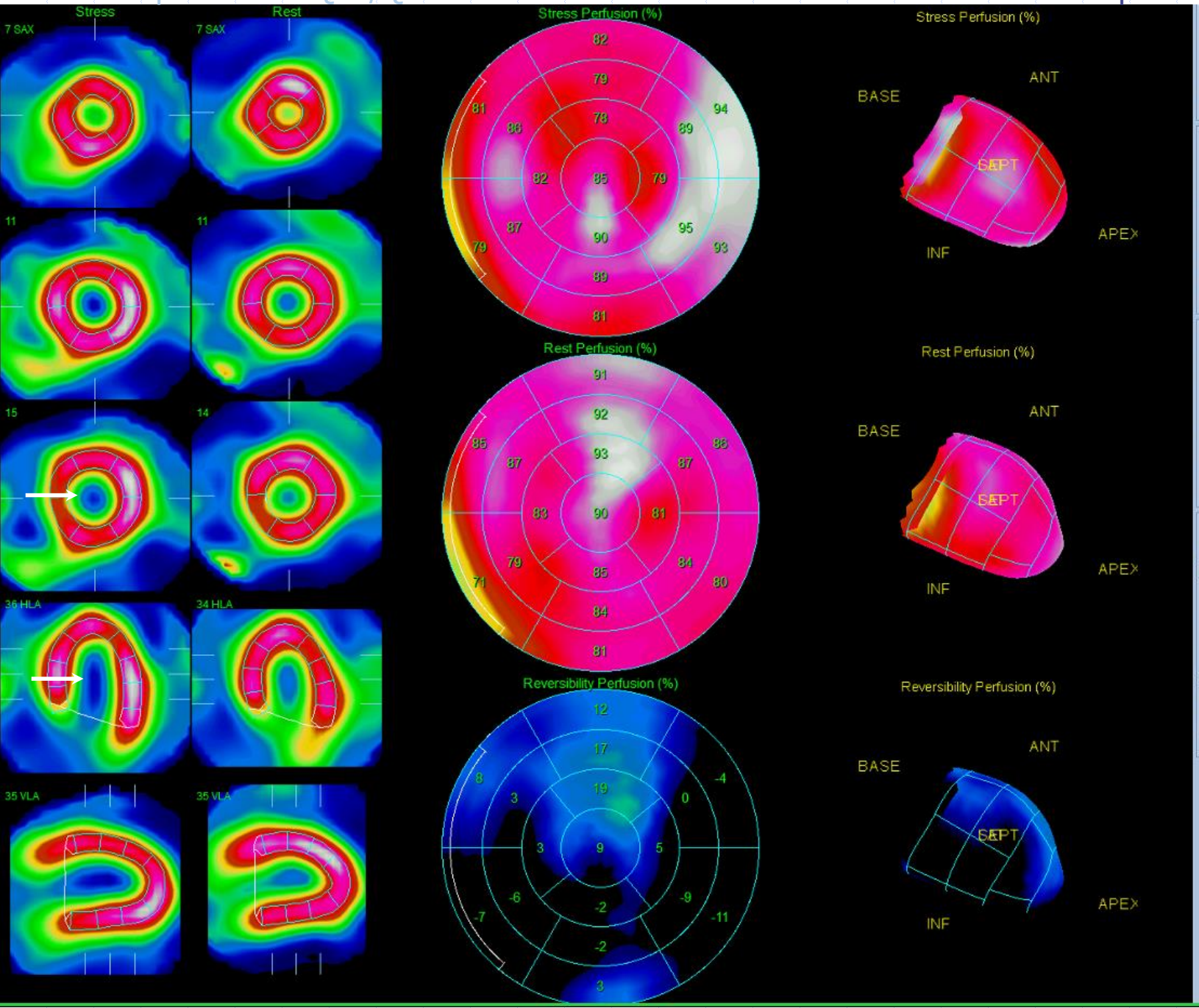

MOTION
Motion (0-10mm)
Thickening (%)
THICKENING
QPS
STRESS
REPOS
ED
ES
ED
ES
PRONE
BASE
STRESS_IRNC(G)
REST_IRNC(G)
APEX
<---- Septal Vertical Axis Lateral ---->
normal
SEP
<---- Inferior Horizontal Axis Anterior ---->



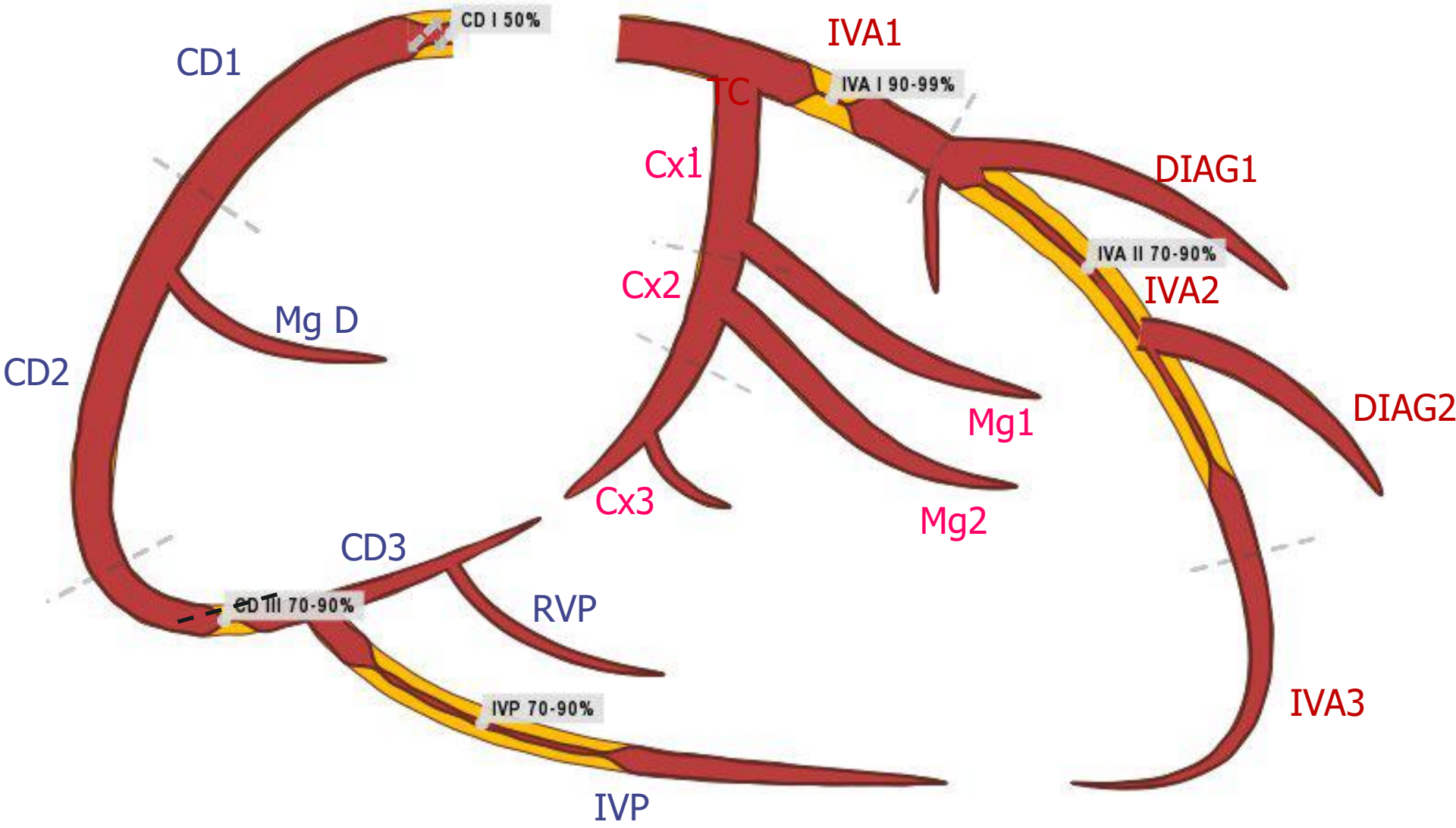

Homme de 75 ans, douleurs thoraciques suspectes, fugaces.

EE maximale sous persantine sans douleur. Sous décalage douteux en V4-V6

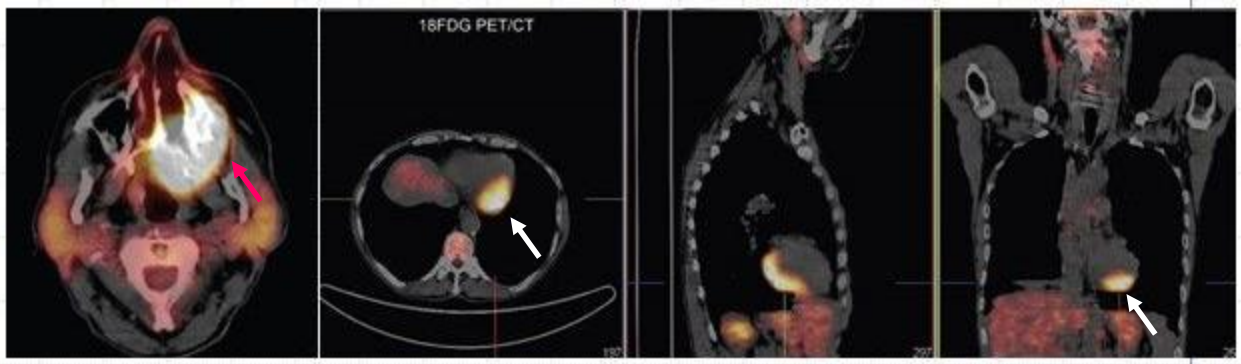


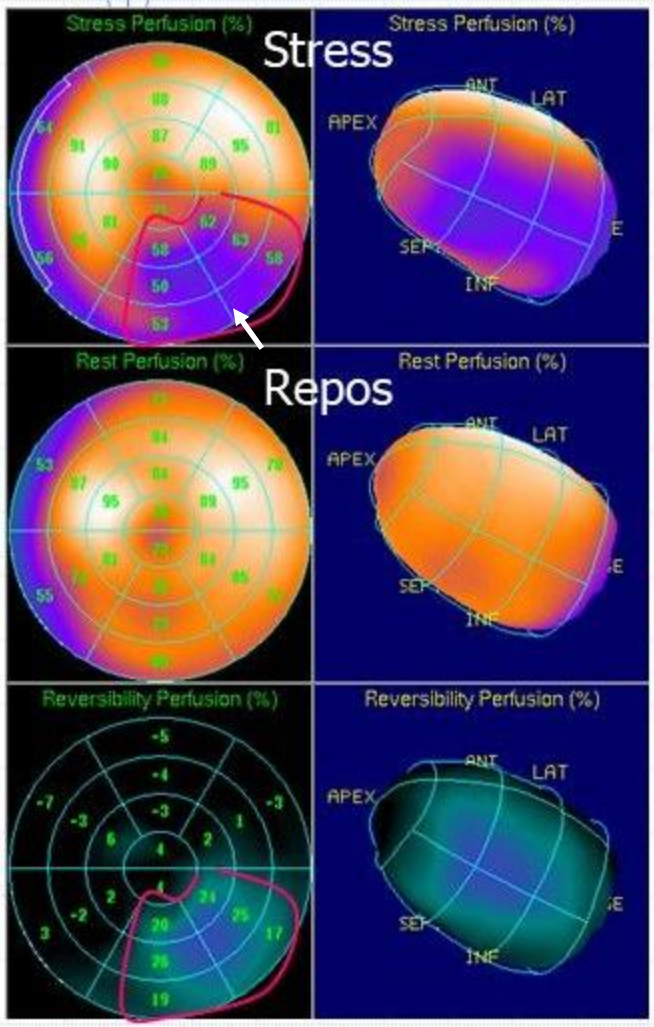

Stress
Rest
7 SAX
11
15
14
36 HLA
34 HLA
35 VLA
Stress Perfusion (%)
Rest Perfusion (%)
Reversibility Perfusion (%)
BASE
ANT
INF
APEX
SEPT
Name
Pat ID
Sex
Limits --
SSS 0 SRS 0 SDS 0
SS% 0 SR% 0 SD% 0
Study MED-NUC-LAP-MIBI 1 JOUR
Dataset STRESS_IRNC
Date 2022-
Database MaleProneStressMB
Volume 41ml
Area 74cm²
Defect 8cm²
Extent 11%
TPD 11%
Eccentricity 0.84
Study MED-NUC-LAP-MIBI 1 JOUR
Dataset REST_IRNC
Date 2022-
Database <No Matches>
Volume 31ml
Area 66cm²
Defect --
Extent --
TPD --
Eccentricity 0.80
Str
Rst
Rev
Auto
0
-
Grid
Accept
Reject

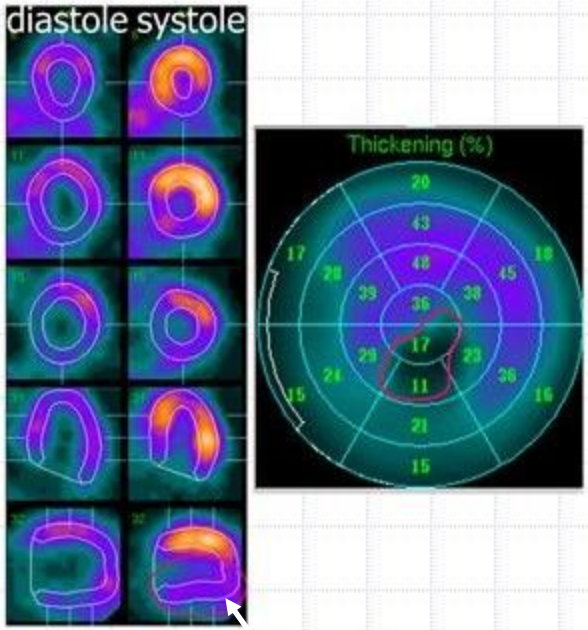
41/31 = 1,32

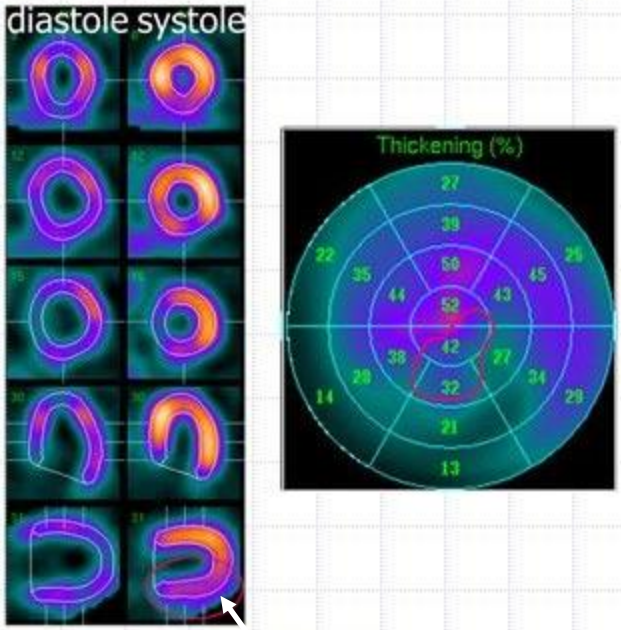

CD I 50%
CD1
IVA1
TC
IVA I 90-99%
Cx1
DIAG1
IVA II 70-90%
Cx2
IVA2
Mg D
CD2
DIAG2
Mg1
Cx3
Mg2
CD3
CD III 70-90%
RVP
IVA3
IVP 70-90%
IVP

# H 53a,HIV LBGC



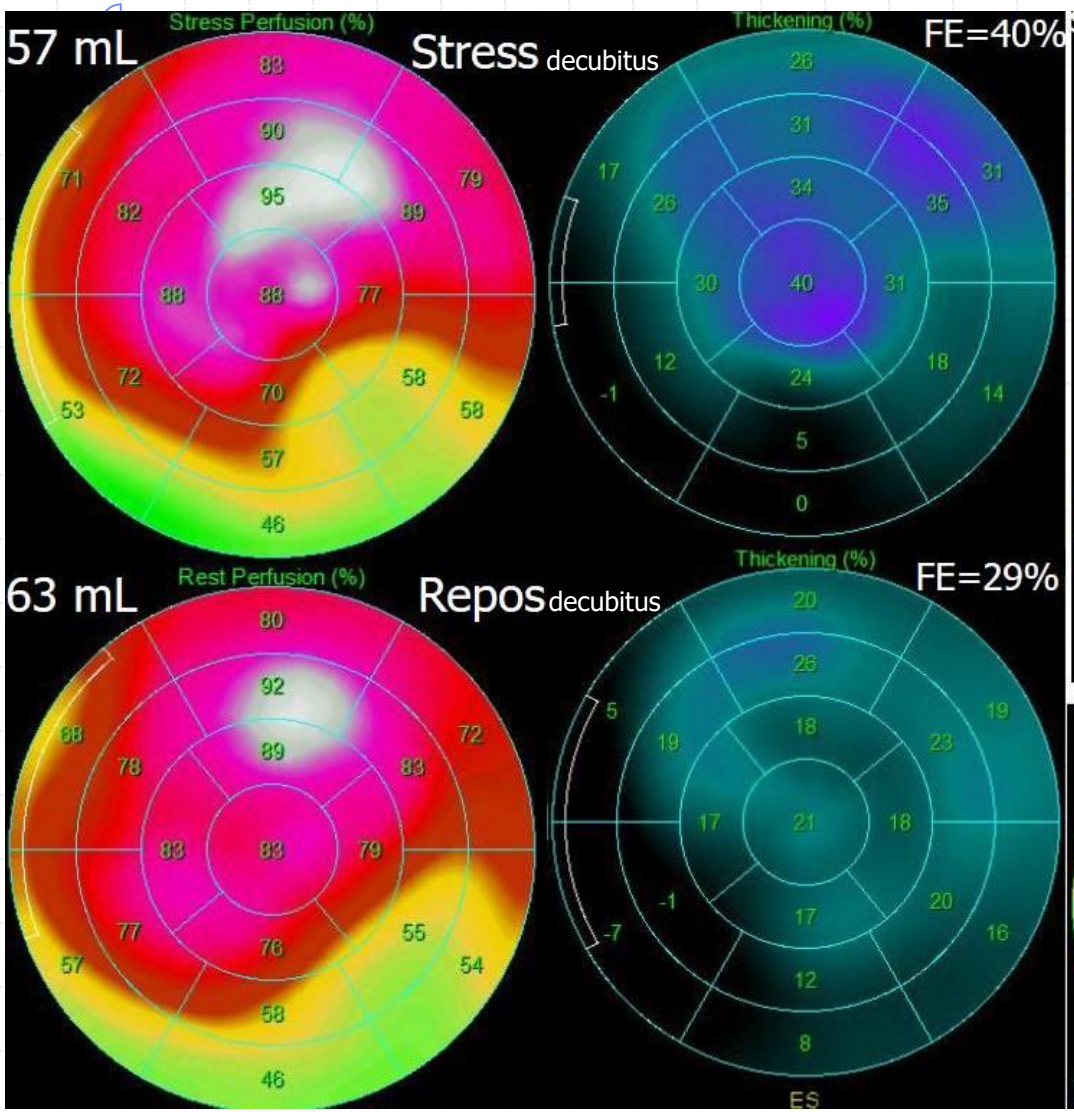

EFFORT
ES(apico-inf) = 11-17%

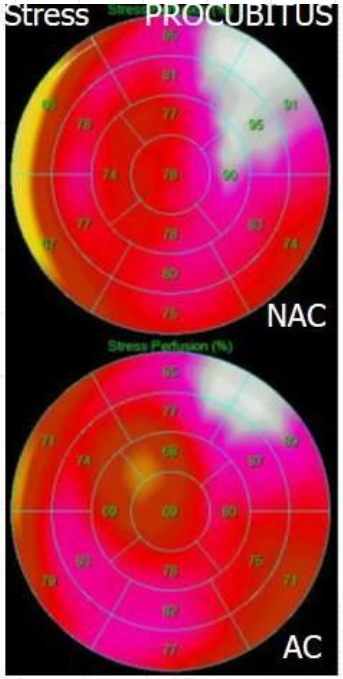
REPOS
ES(apico-inf) = 32-42 %

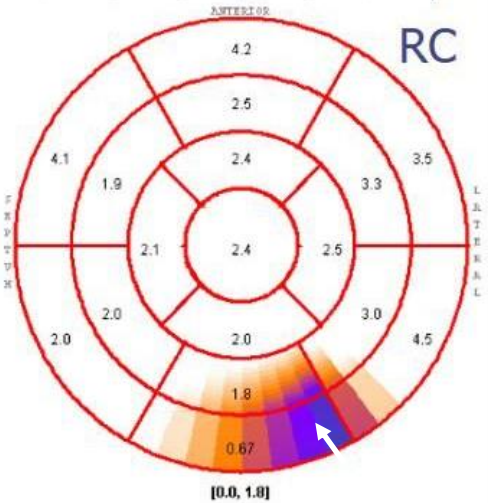
SIDERATION DE STRESS INFERO-LAT / Cx SUB OCCLUSE

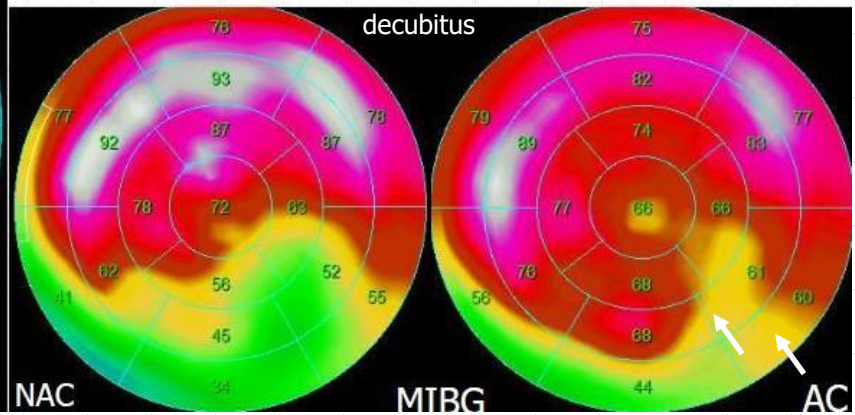
J Am Coll Cardiol 2002;39:991-8 - Clin Nucl Med 2009;34(10) :731-3

# Homme 70 ans stenté IVA3, DG2, CD2; Q inf et Hypokinésie inférobasale à l'écho. H/M = 1,7



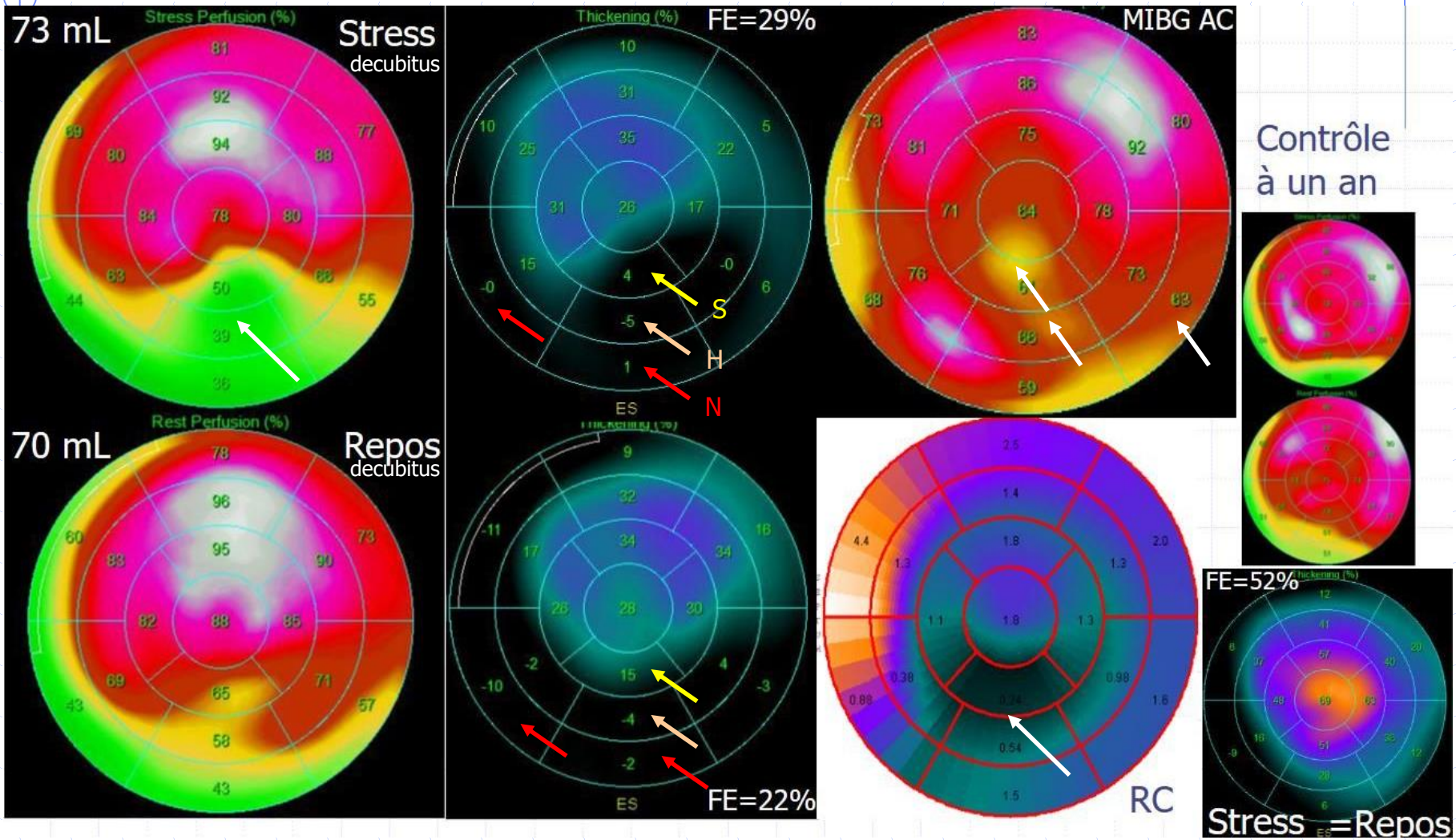



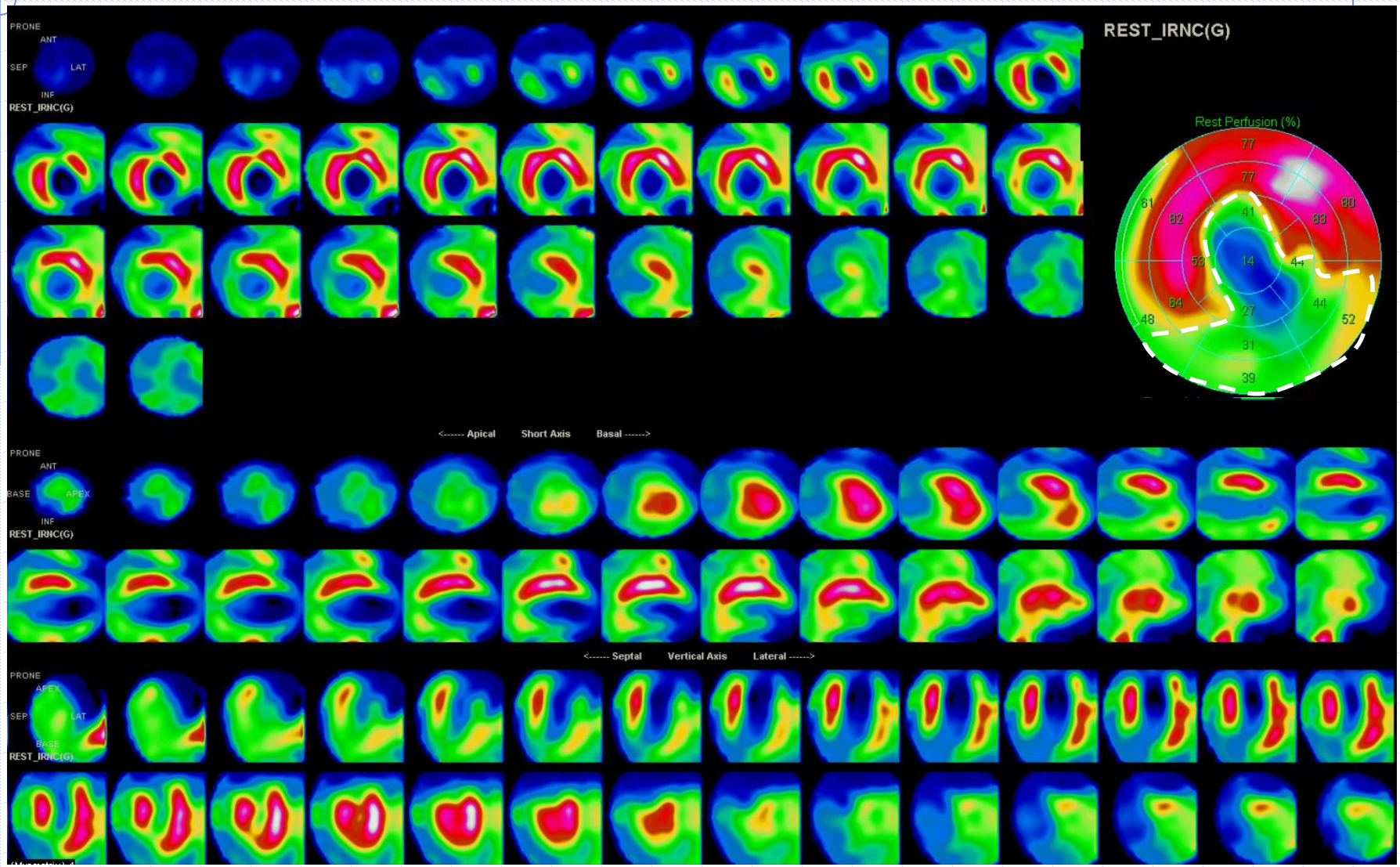



# Femme 49 ans FRCV stentée CD et RVP

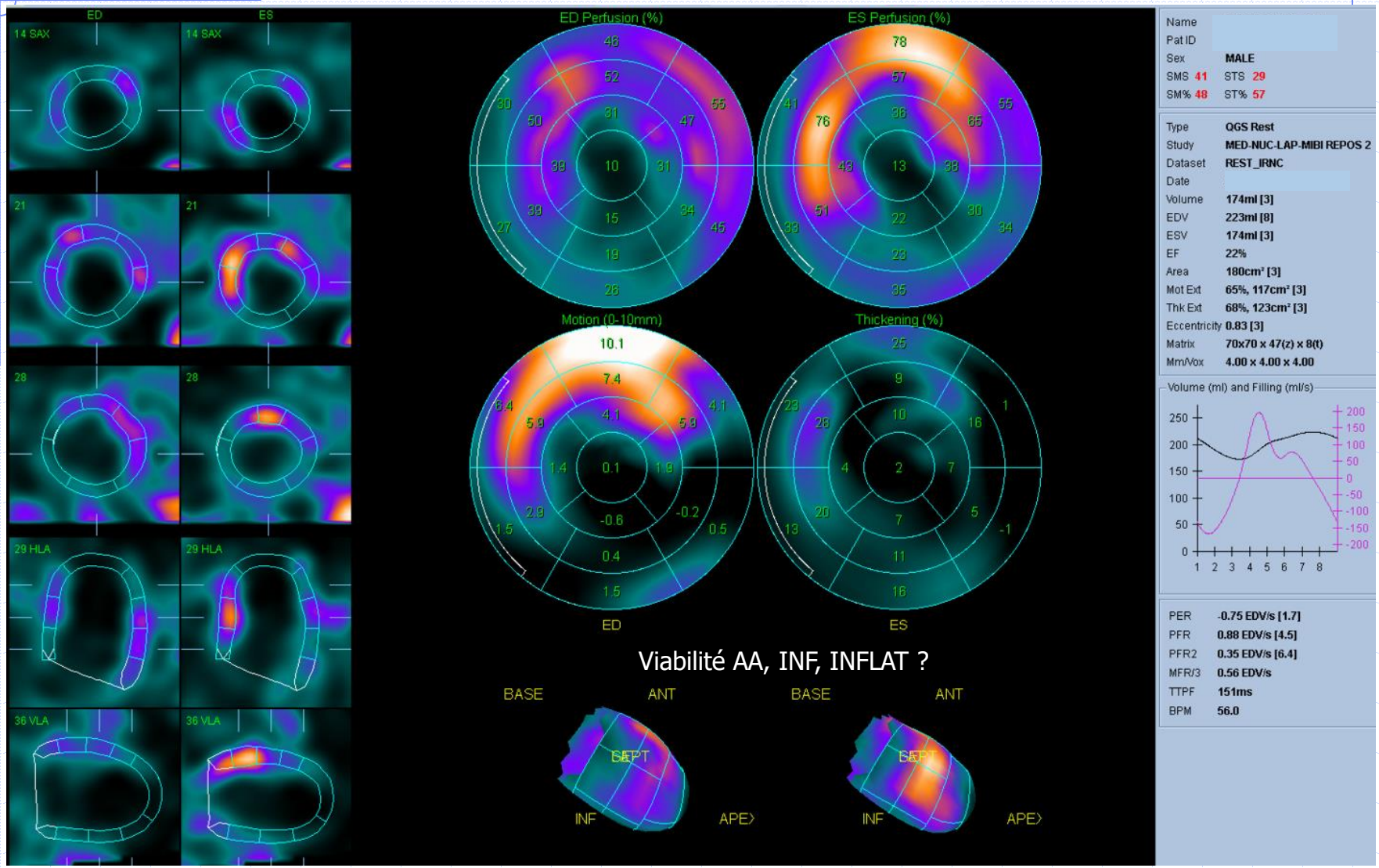
# H/M = 1,5



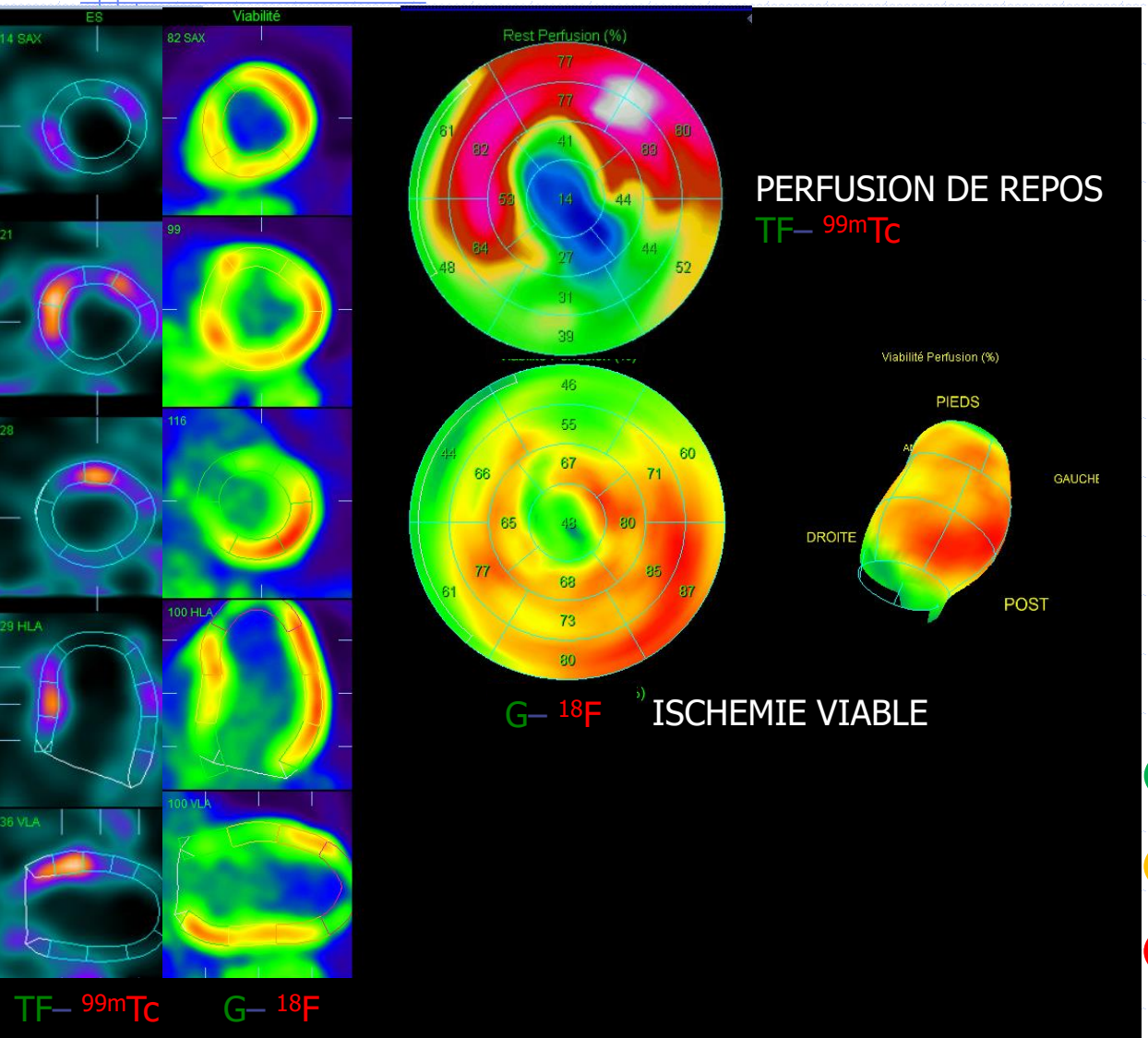
# Homme 49 ans tri-tronculaire. Sténoses Mg1, D1 Occlusions chroniques IVA2, Cx1, CD1. Lésion TC

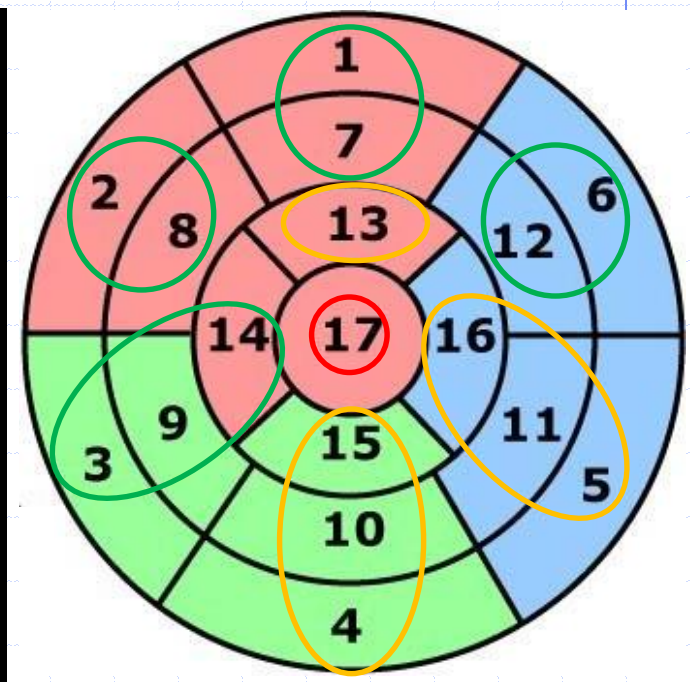


# Homme 49 ans tri-tronculaire. Sténoses Mg1, D1 Occlusions chroniques IVA2, Cx1, CD1. Lésion TC



# Homme 49 ans tri-tronculaire. Sténoses Mg1, D1 Occlusions chroniques IVA2, Cx1, CD1. Lésion TC



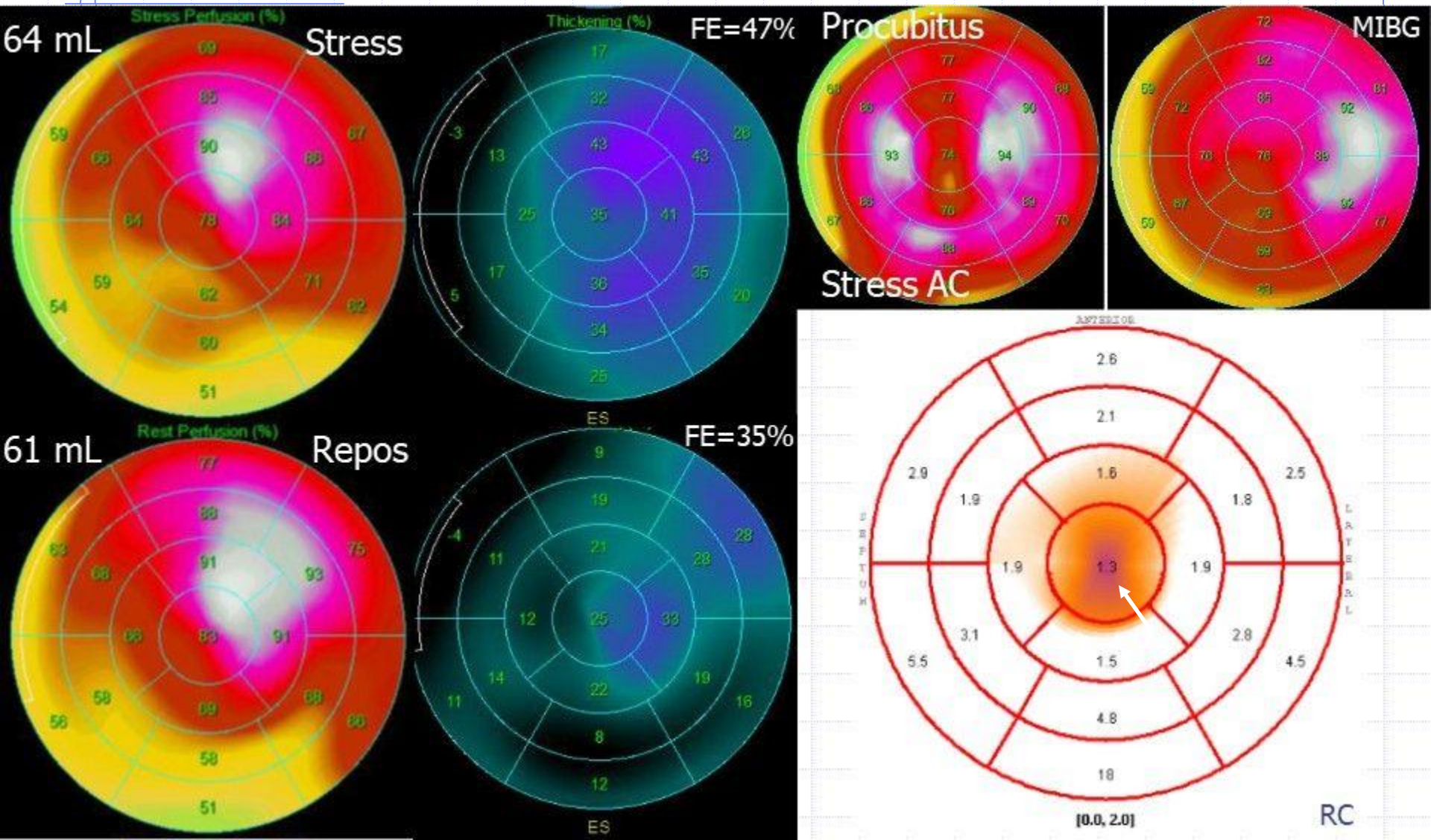




normal au repos

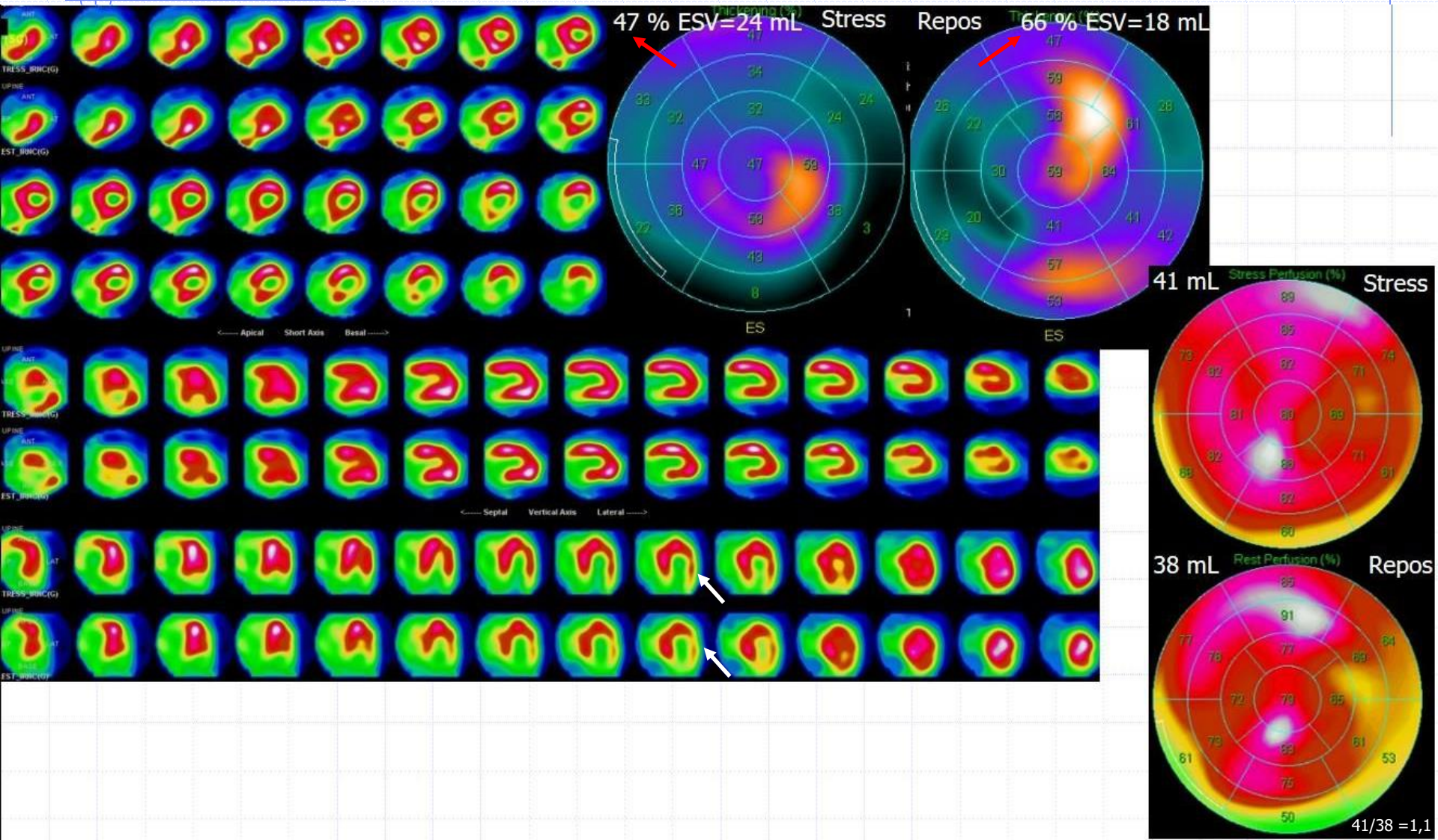
hibernation

nécrose

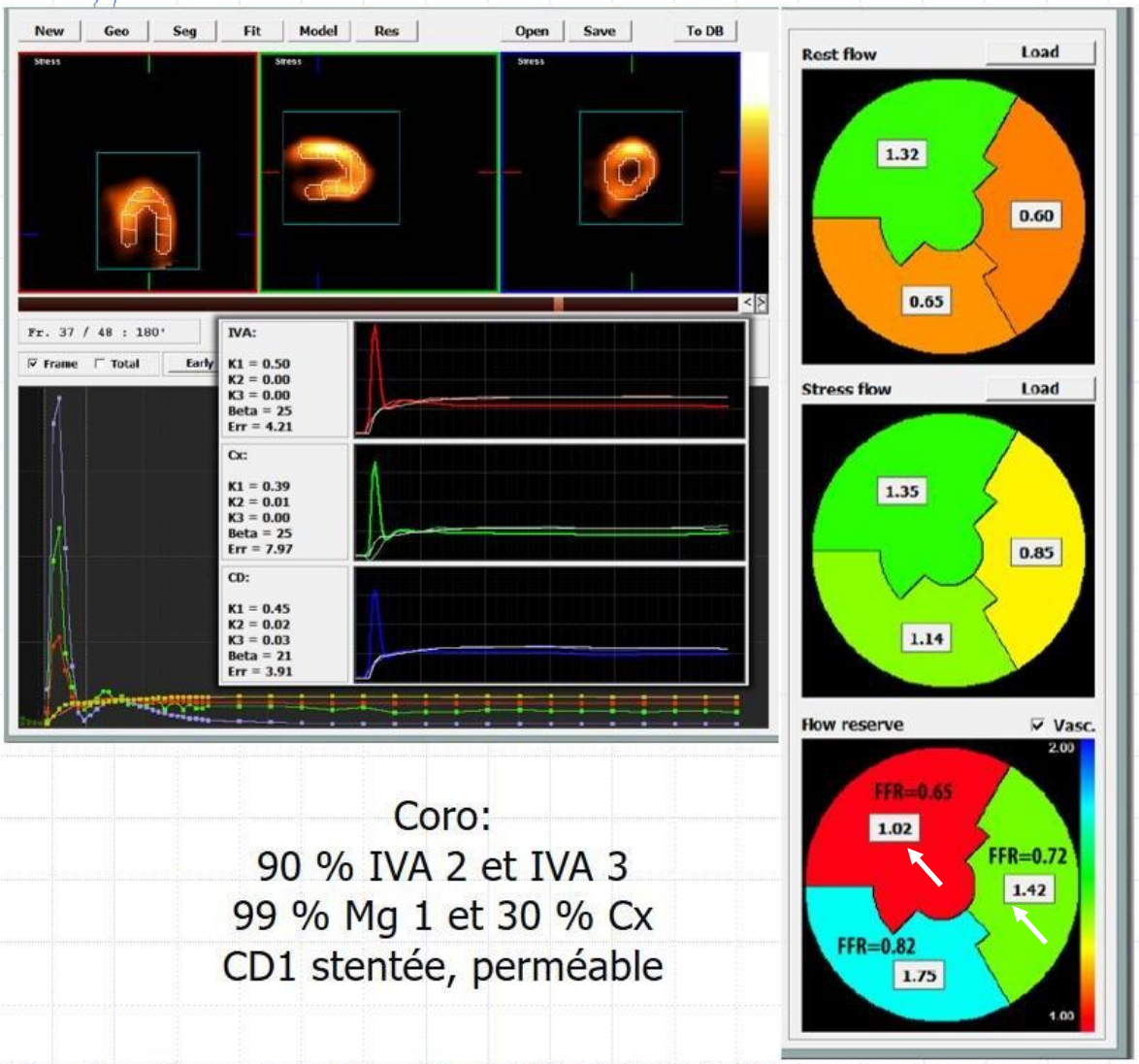
# Homme 74 ans. Stent sur IVA1 compliqué d'un embol occlusif dans l'IVA3. Pas d'onde Q. H/M=1,6



# Homme 58 ans FRVC. Stent sur CD1. Lésions IVA 2,3 et Mg. EE maximale normale.

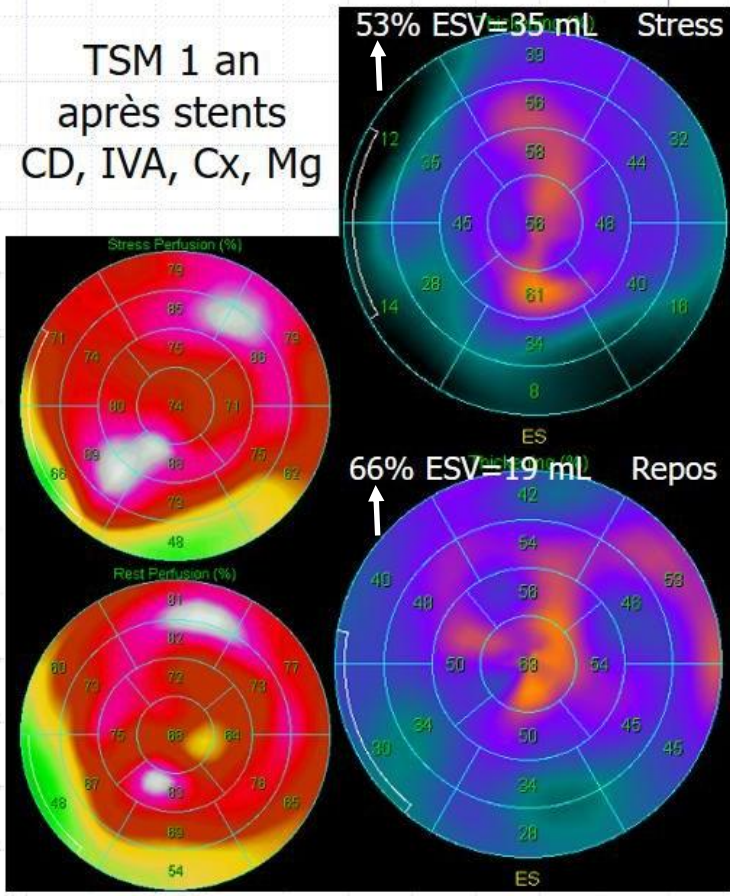


# Homme 58 ans FRVC. Stent sur CD1. Lésions IVA 2,3,Mg. EE normale. Perfusion normale

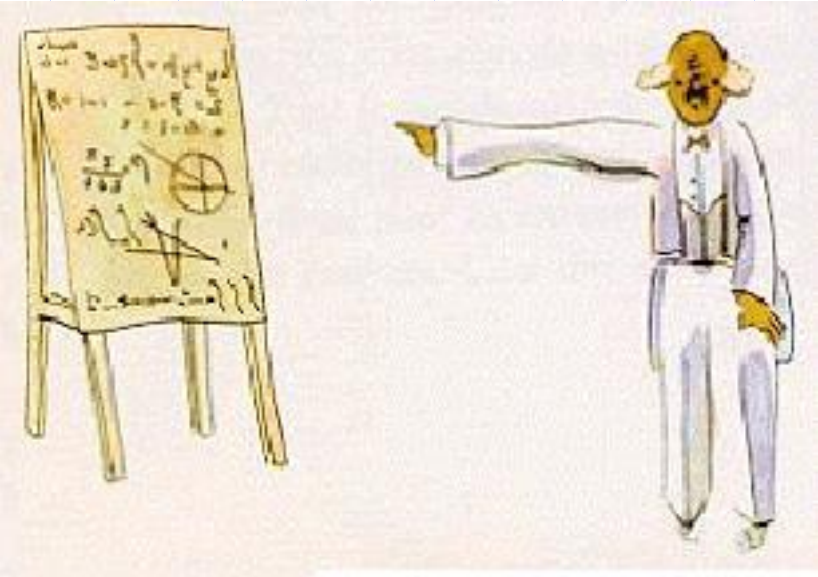



Coro:
90 % IVA 2 et IVA 3
99 % Mg 1 et 30 % Cx
CD1 stentée, perméable

TSM 1 an
après stents
CD, IVA, Cx, Mg




F Ben Bouallègue et al , J Nucl Med 2015; 56:1712-1717



# Merci pour votre attention…

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