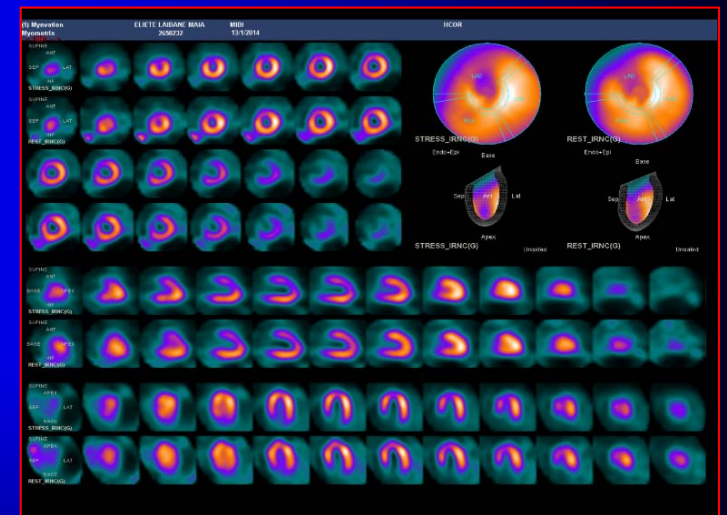
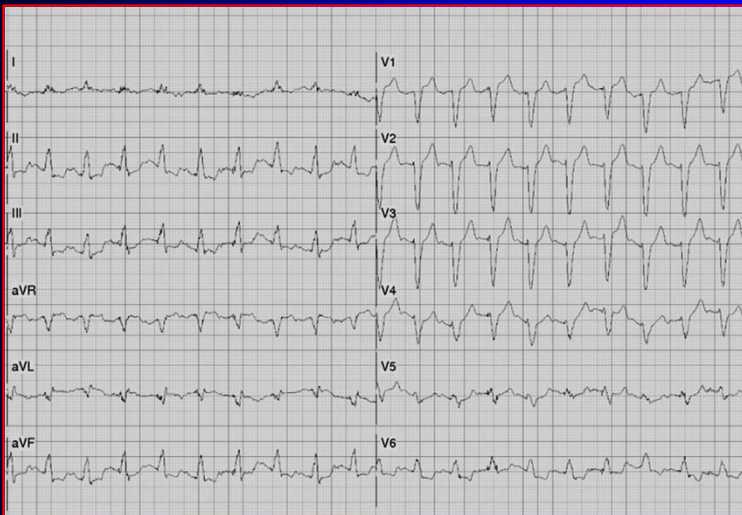
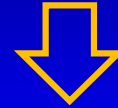
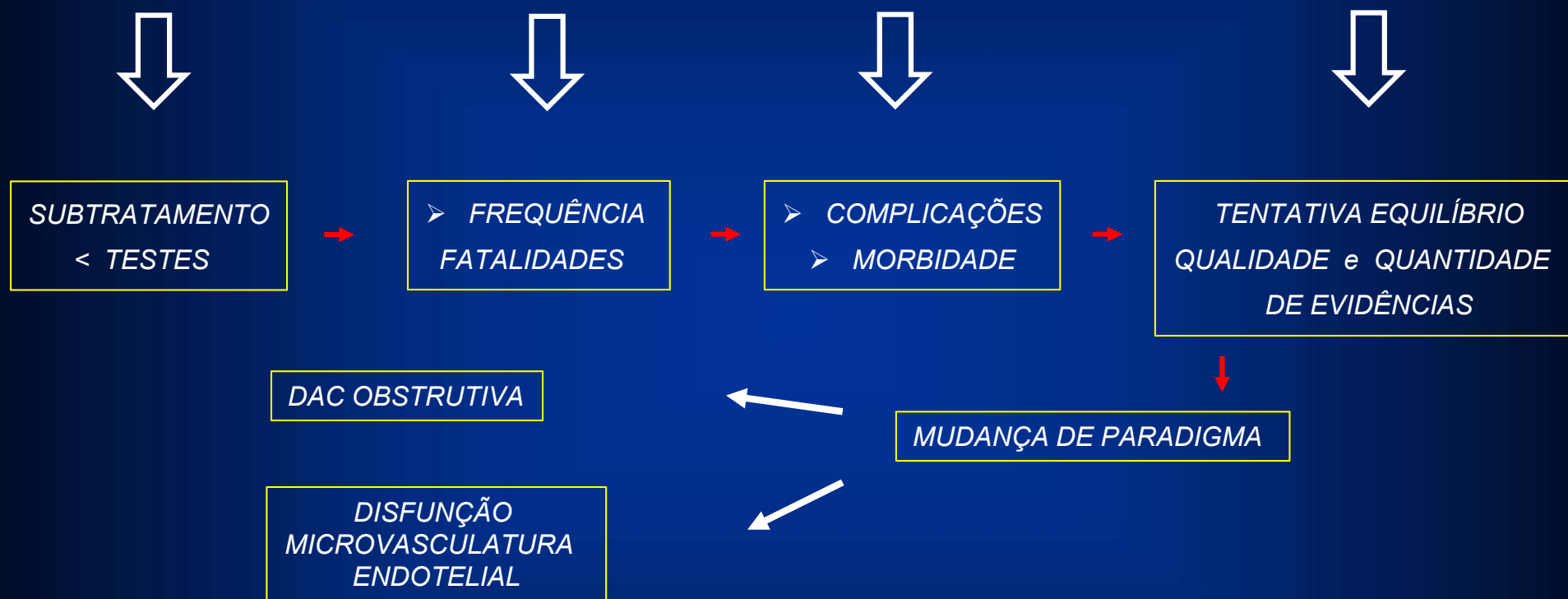


# TESTE ERGOMÉTRICO NAS MULHERES



AUSÊNCIA DE CONFLITO DE INTERESSES

# DÉCADAS RECENTES - SEXO FEMININO = POPULAÇÃO PRIORITÁRIA



Mieres JH, Gulati M, Merz NB et al. AHA Cardiac Imaging Committee of the Council on Clinical Cardiology and the CVAS Imaging and Intervention Committee of the Council on Cardiovascular Radiology and Intervention. Role of noninvasive testing in the clinical evaluation of women with suspected ischemic heart disease: a consensus statement from the AHA. *Circulation*. 2014;130:350-379

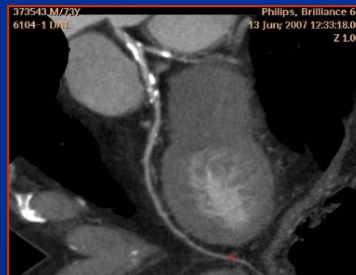
TE x DETECÇÃO CA<sup>++</sup> x ANGIO CT x GATED SPECT <sup>99m</sup>TC - MIBI x PET x ECO

Detecção

QUEBRA DE PARADIGMA

Estratificação - Risco

Pré-Clínica



Pré-Clínica

MORTALIDADE

< 1% BR

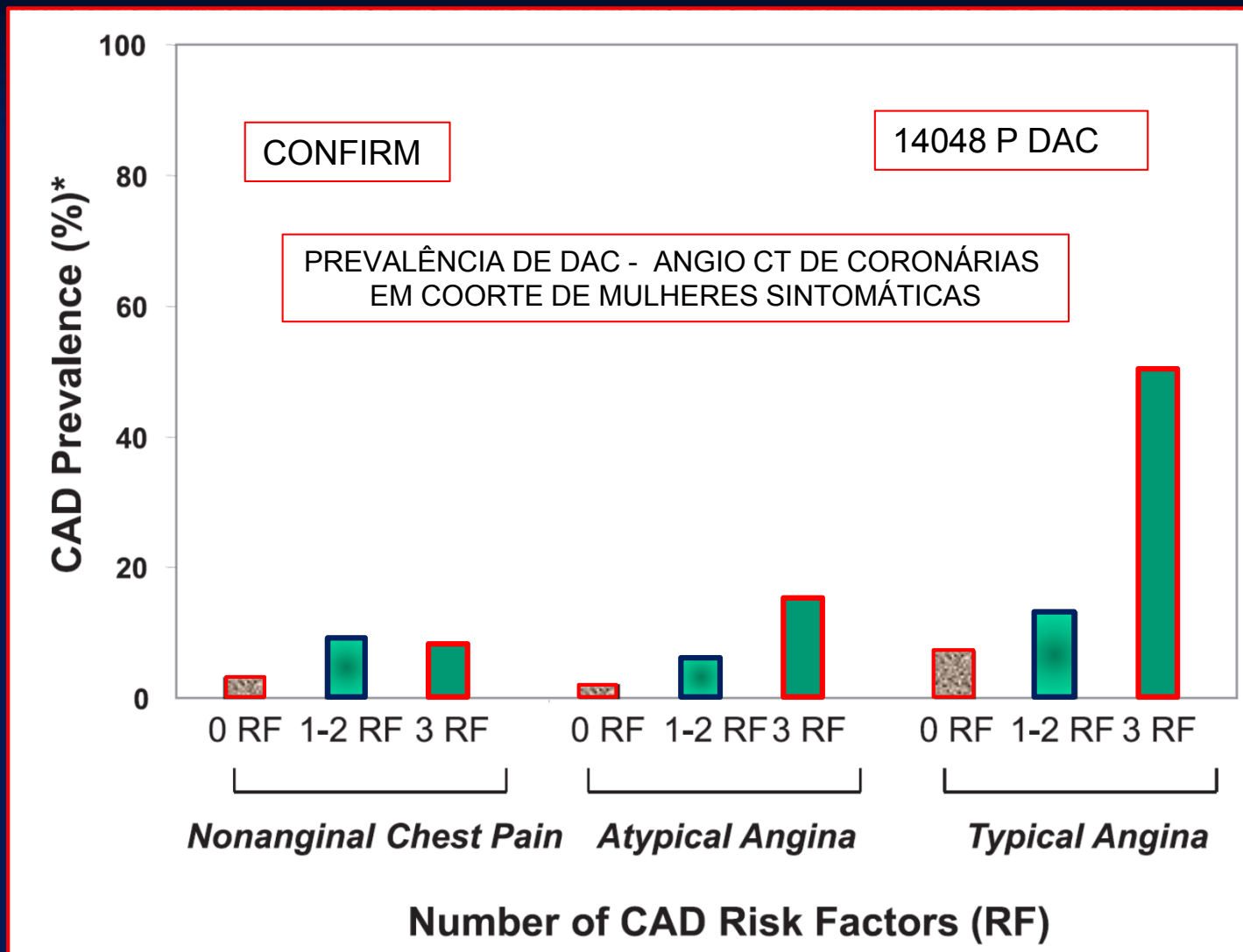
1 - 3% RI

> 3% AR

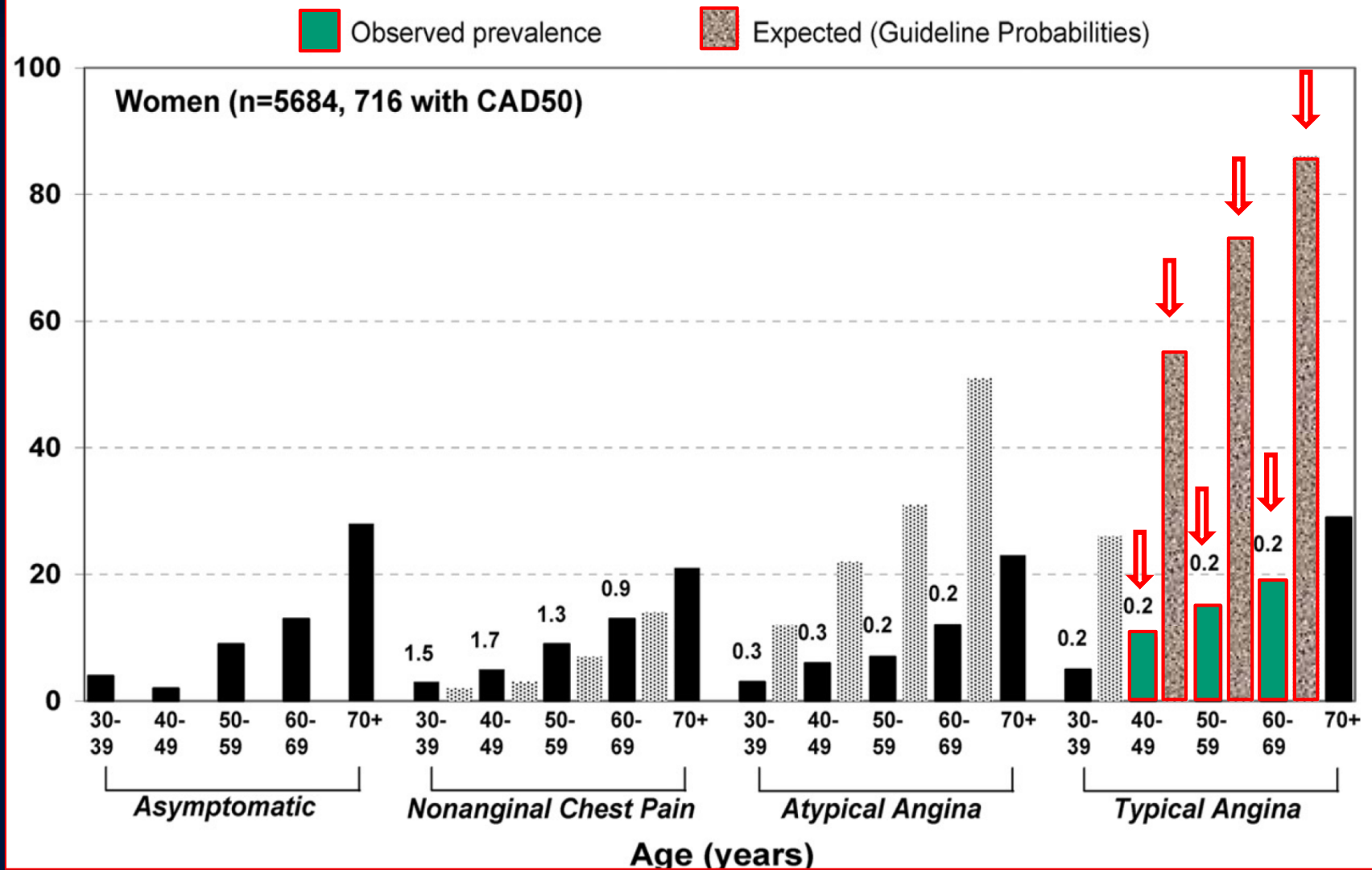
Gibbons R et al. ACC/AHA Guidelines for management of patients with chronic stable angina. J. Am. Coll., 1999; 33:2092-97. Berman DS et al. Roles of nuclear cardiology, CCT and CMR: Noninvasive risk stratification and a conceptual framework for the selection of noninvasive imaging tests in patients with known or suspected CAD J Nucl Med 47:1107, 2006. Detrano RC et al. CAC as a predictor of coronary events in four racial or ethnic groups. N Engl J Med 358:1336, 2008.

<b>VARIÁVEIS</b>	<b>DIAMOND FORRESTER</b>	<b>FRAMINGHAM</b>	<b>PROCAM</b>	<b>SCORE</b>
<b>Idade</b>	+	+	+	+
<b>Sexo</b>	+	-	-	+
<b>Diabetes</b>	-	+	-	-
<b>Tabagismo</b>	-	+	+	+
<b>AF + para IM</b>	-	-	+	-
<b>Tipo de dor torácica</b>	+	-	-	-
<b>PAS tratada</b>	-	+	+	-
<b>PAS não tratada</b>	-	+	-	-
<b>HDL col.</b>	-	+	+	-
<b>LDL col.</b>	-	-	+	-
<b>Triglicérides</b>	-	-	+	-
<b>Colesterol total</b>	-	+	-	+
<b>Baixo risco</b>	<30%	<10%	<10%	0-4%
<b>Risco intermediário</b>	30-70%	10-20%	10-20%	5-9%
<b>Alto Risco</b>	>70%	>20%	>20%	≥10%

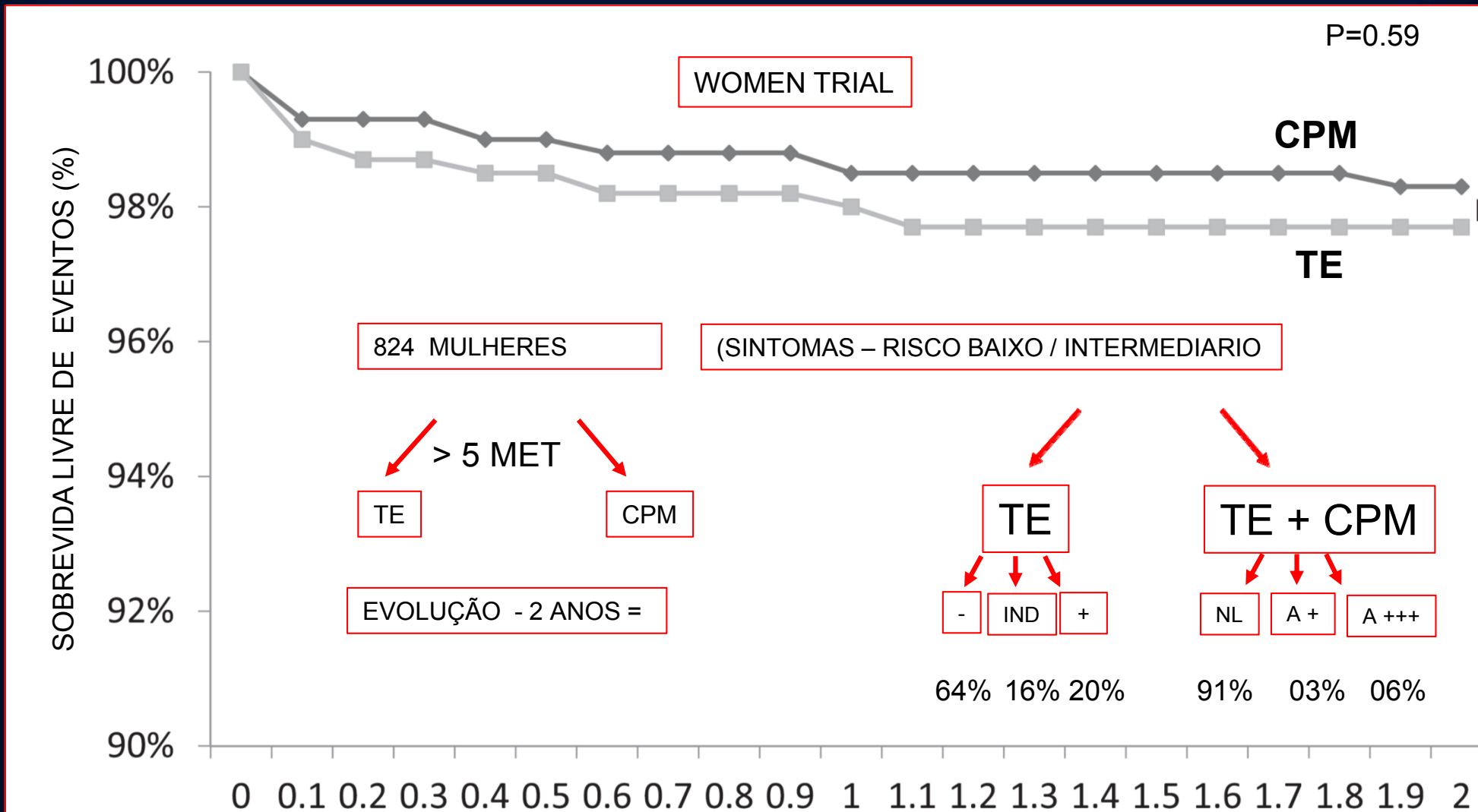
Versteylen MO, Joosen IA, Shaw LJ, Narula J, Hofstra L et al., Comparison of Framingham, PROCAM, SCORE, and Diamond Forrester to predict coronary atherosclerosis and cardiovascular events. *Journal of Nuclear Cardiology* 2011; 18(5):904-11)



Cheng VY, Berman DS, Rozanski A et al. Performance of the traditional age, sex, and angina typicality- based approach for estimating pretest probability of angiographically significant CAD in patients undergoing CCTA: results from the multinational coronary CT angiography evaluation for clinical outcomes: an international multicenter registry (CONFIRM). *Circulation*. 2011;124:2423-2432.



Cheng VY, Berman DS, Rozanski A et al. Performance of the traditional age, sex, and angina typicality- based approach for estimating pretest probability of angiographically significant CAD in patients undergoing CCTA: results from the multinational coronary CT angiography evaluation for clinical outcomes: an international multicenter registry (CONFIRM). *Circulation*. 2011;124:2423-2432.



Shaw LJ, Mieres JH, Hendel RH et al.; for the WOMEN Trial Investigators. Comparative effectiveness of exercise EKG with or without myocardial perfusion SPECT in women with suspected CAD: results from the What Is the Optimal Method for Ischemia Evaluation in Women (WOMEN) trial. *Circulation*. 2011;124:1239–1249.

*Myocardial ischemia is associated with higher IHD mortality among symptomatic women than among men*

*Hemingway H, McCallum A, Shipley M et al . Incidence and prognostic implications of stable angina pectoris among women and men. JAMA. 2006;295:1404–1411.*

*The concept that symptoms in women are correlated with coronary vascular dysfunction in the setting of arterial expansive remodeling and nonobstructive plaque is a critical component for understanding female-specific patterns in symptom presentation and elevated IHD risk.*

*Shaw LJ et al.; WISE Investigators. Insights from the NHLBI-sponsored Women's Ischemia Syndrome Evaluation (WISE) study: part I: gender differences in traditional and novel risk factors, symptom evaluation, and gender-optimized diagnostic strategies. J Am Coll Cardiol. 2006;47(suppl):S4-S20.*

*Shaw LJ et al. Women and ischemic heart disease: evolving knowledge. J Am Coll Cardiol. 2009;54:1561–1575.*



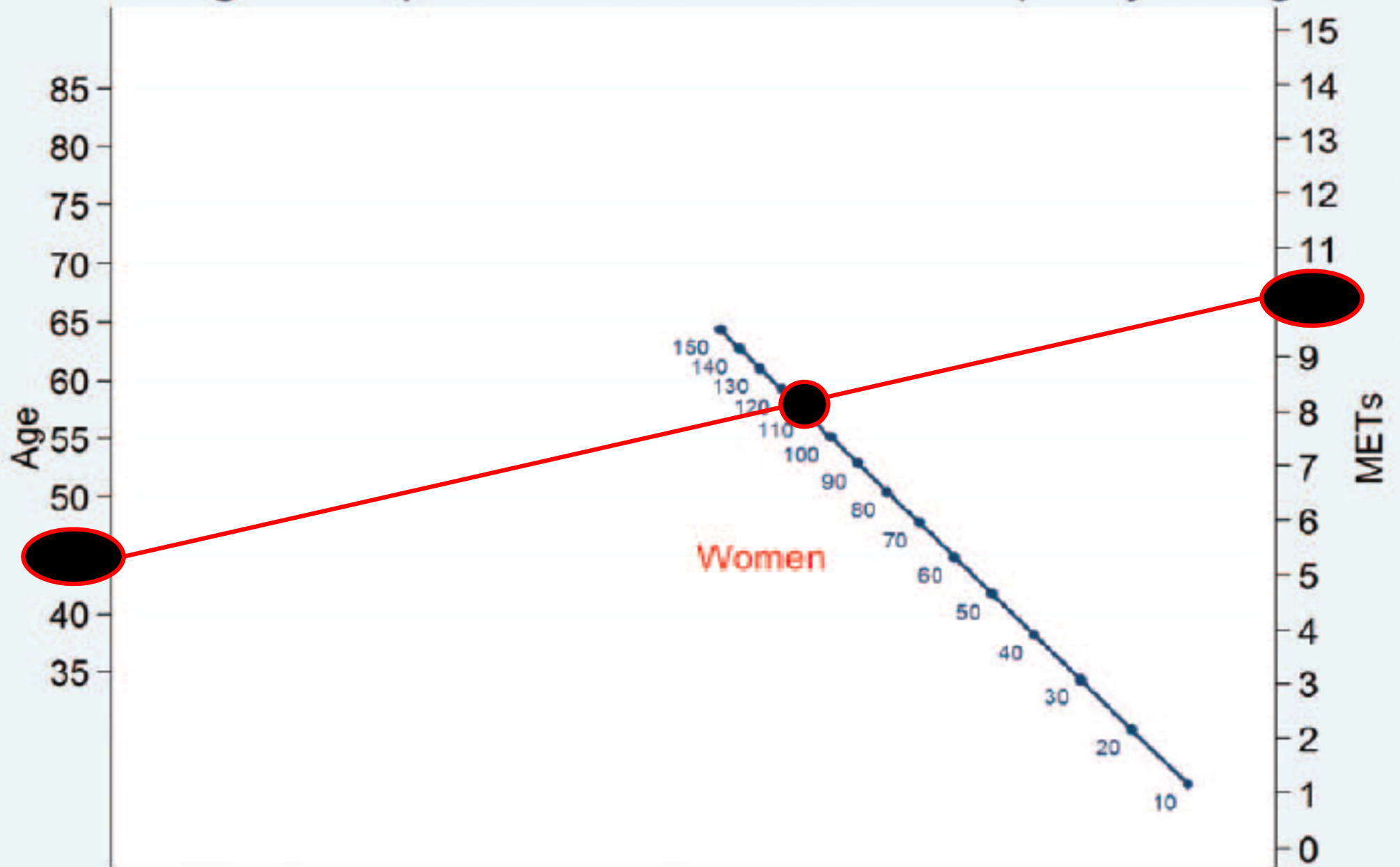
# ACC/AHA Guideline on the Assessment of Cardiovascular Risk

**Questões Críticas (CQ1):** Qual é a evidência de contribuição à abordagem ou reclassificação de risco quando novos marcadores são adicionados aos escores tradicionais.

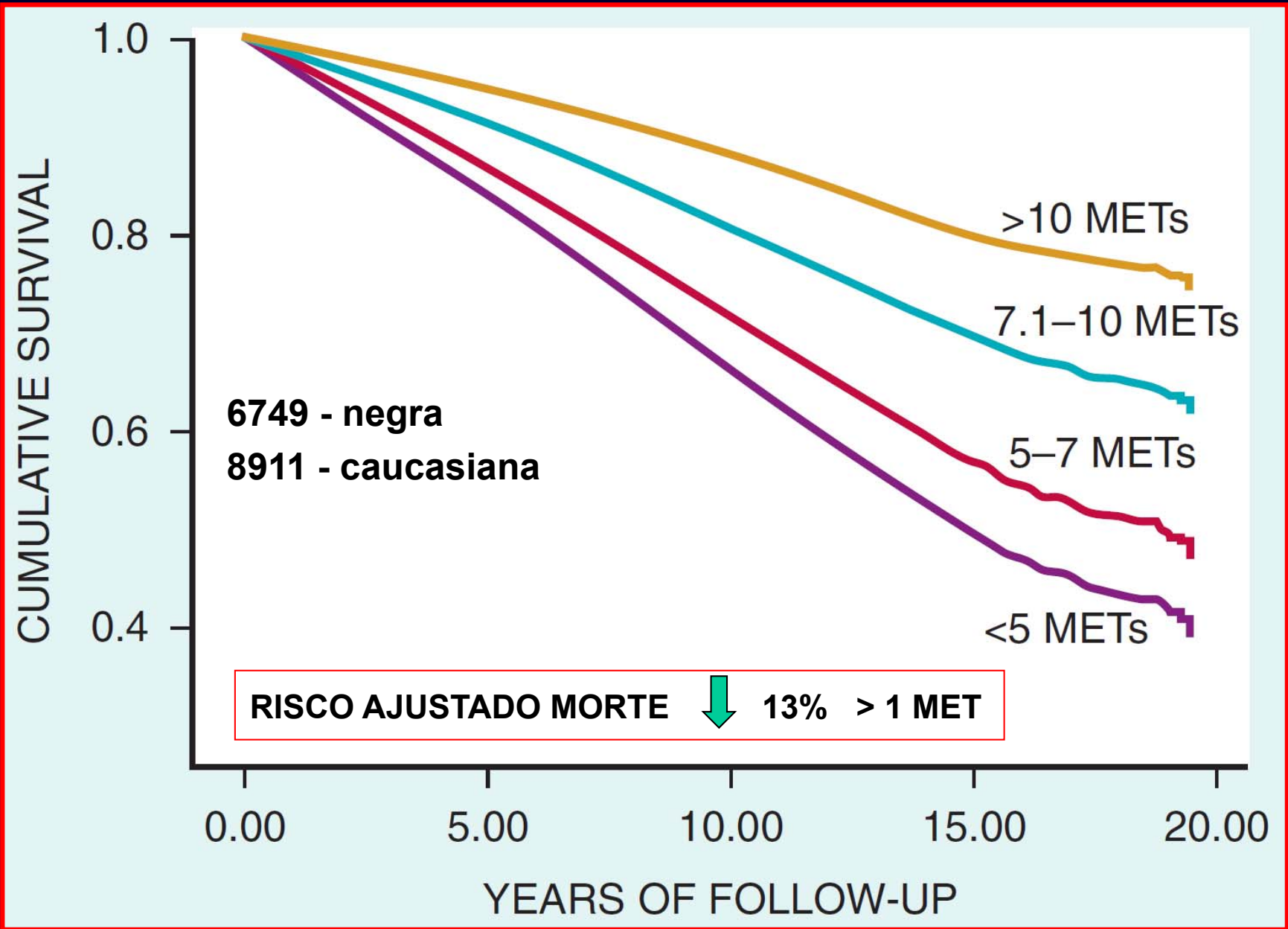
- PCR - alta sensibilidade,
- Apolipoproteína B,
- Taxa de Filtração Glomerular,
- Microalbuminúria, Índice tornozelo - braquial,
- História Familiar, **Capacidade Funcional,** ←
- Espessura íntima/média de carótida,
- **Escore de Cálcio Coronário**

1

# Nomogram of percent normal exercise capacity for age

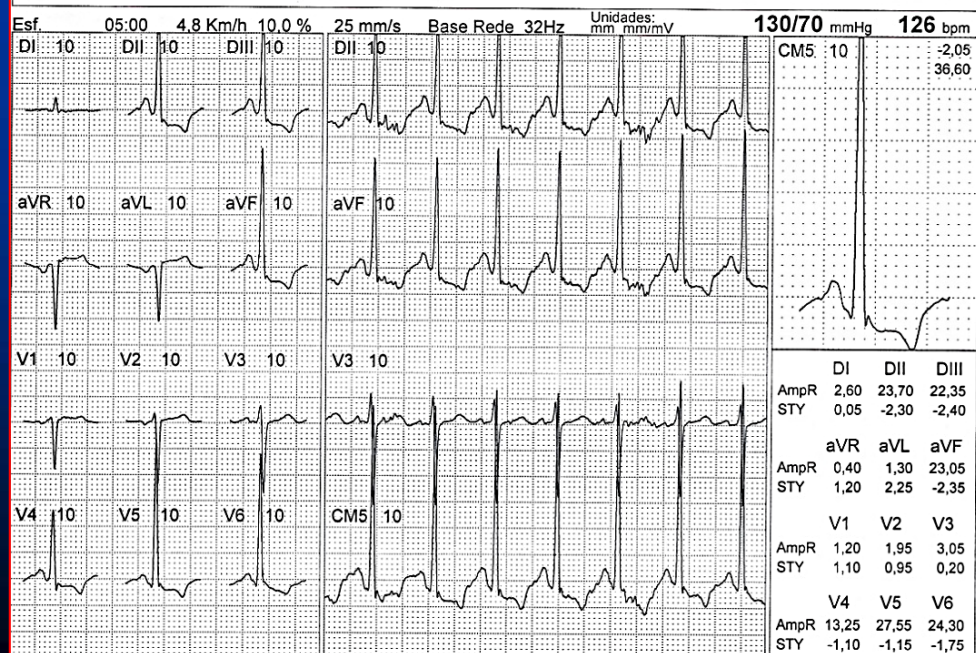
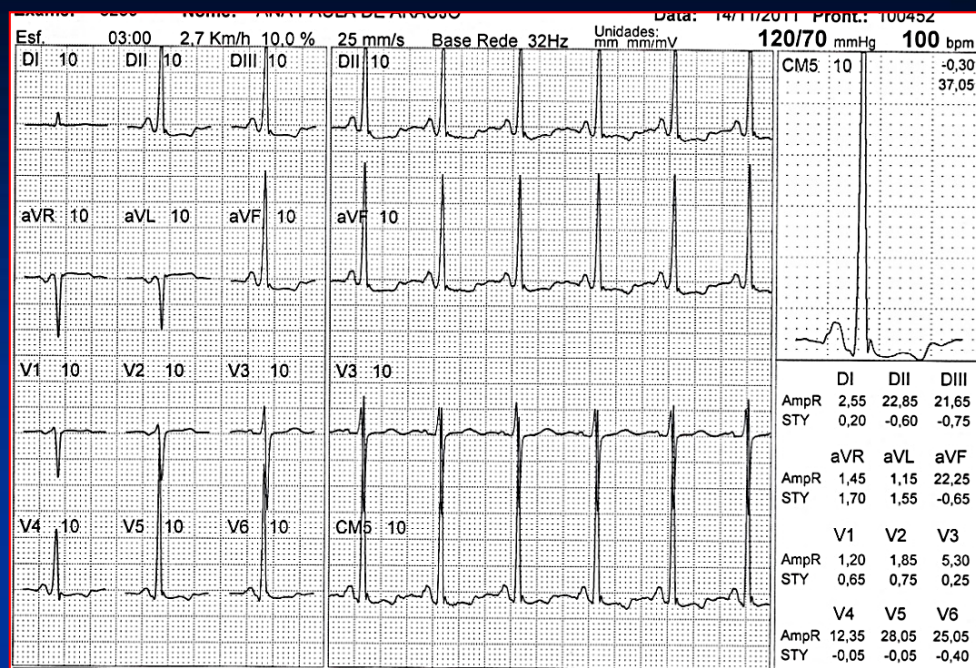


1



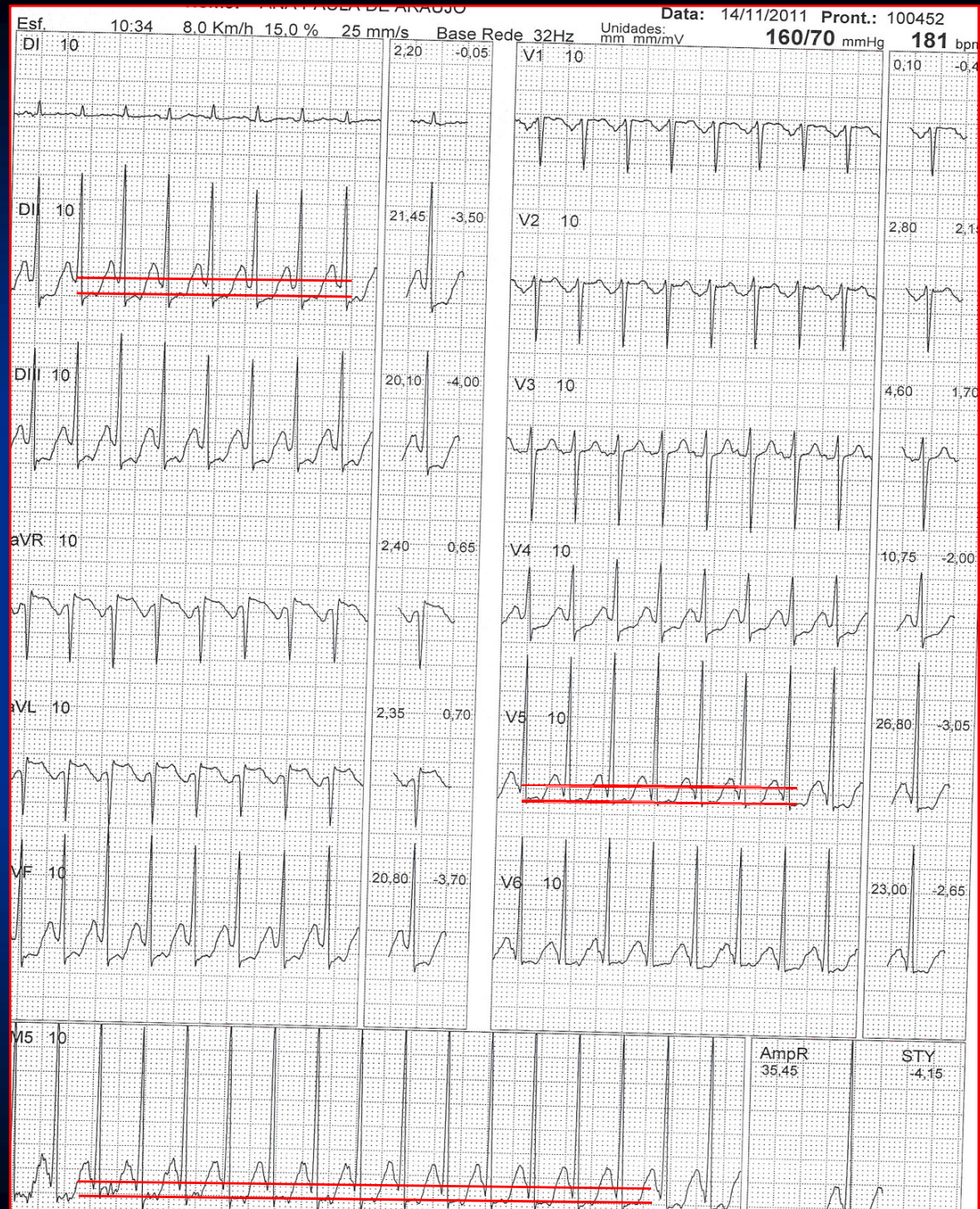
Kokkinos P, Myers J, Kokkinos JP, et al: Exercise capacity and mortality in black and white men. Circulation 117:614, 2008.

# CENÁRIO 1 - 14/11/2011. APA, FEM, ASSINT, 29 a, SEM FR - AVALIAÇÃO DA CAPACIDADE FUNCIONAL.



APA, Fem, Assint, 29 a, sem FR  
Avaliação da CAP. funcional.

Pico do esforço  
ELLESTAD - Etapa V  
TT = 10,34 min  
94,7% da FC Max.  
Prova interrompida  
por exaustão



2

# ESCORES PROGNÓSTICOS

2842 P - Cine + TE

DUKE

613 P - ROC = 0.849

$$E = TT \text{ (min)} - (5 \times ST) - (4 \times \text{índice angina})$$

↓ 13 %

**ALTO RISCO**

< - 11

↓ 53 %

**MOD RISCO**

- 10 a + 4

↓ 34 %

**BAIXO RISCO**

≥ 5

Sobrevida → 67%

91%

→ 97 - 99%

Livres Eventos 62%

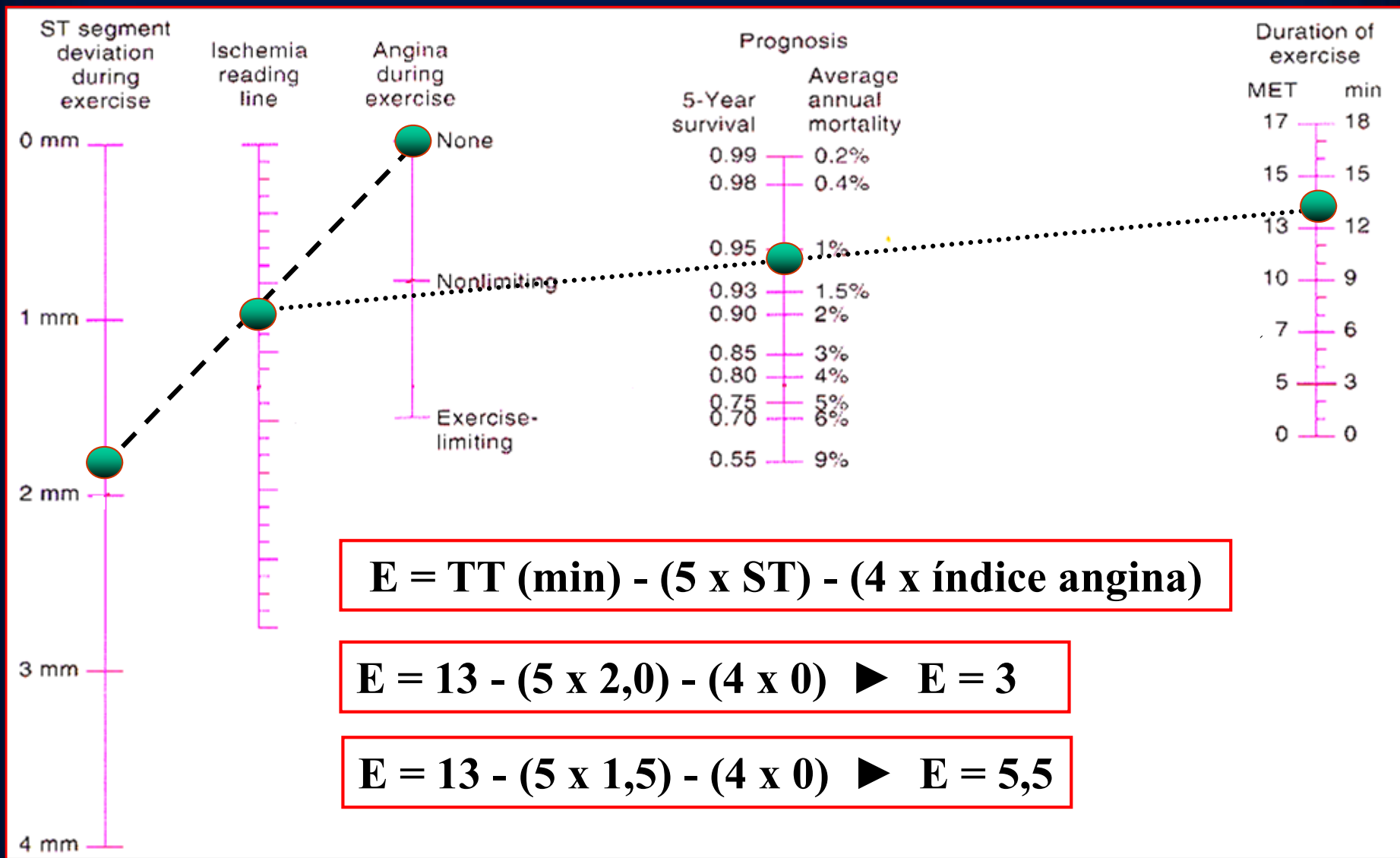
86%

93%

Mark, D.B. et al. - Ann. Inter. Med. 1987, 106(6):793-800 / N. Eng. J. Med., 1991, 325(12):887;  
Meneghelo RS et al. III Diretrizes da SBC - TE. ABC 2010; 95(5 supl.1): 1-26

**CENÁRIO 1 - 14/11/2011. APA, 29 a, SEM FR - AVALIAÇÃO DA CAPACIDADE FUNCIONAL.**

2



Morise Pós TE

Sexo Fem.

BR = < 40

MR = 40 - 60

AR = > 60

442 P

Dor Torácica

TE + Cine

Modelo de  
Regressão  
Logística

DAC > 50%

Variável (ergométrica)	Resposta ao exercício	Pontuação
FC máxima alcançada	< 100	20
	100-129	16
	130-159	12
	160-189	8
	190-220	4
Infradesnível de ST	1-2 mm	6
	> 2 mm	10
Angina induzida pelo esforço	Não limitante	9
	Motivo de interrupção	15
Variável (clínica)	História clínica	
Idade	> 65 anos	25
	50-65 anos	15
Dor torácica – história	Angina	10
	Atípica	6
	Não cardíaca	2
Diabetes melito	Sim	10
Tabagismo	Sim	10
Estado estrogênico	Positivo	-5
	Negativo	5

Morise AP et al. Development and validation of a clinical score to estimate the probability of CAD in men and women presenting with suspected CAD. Am J Med. 1997;102:350–356. Uchida A et al. Revista DERC 2008. Mastrocola et al. 2015 Tratado de Cardiologia SBC.



## MARCADORES CLÍNICOS DE ALTO RISCO - DOENÇA ISQUÊMICA DO CORAÇÃO - MULHERES SINTOMÁTICAS

1. DOENÇA ARTERIAL PERIFÉRICA

2. DIABETES MELLITUS > 10a / CONTROLE IRREGULAR / ♀ > 40 a

3. DOENÇA PULMONAR OBSTRUTIVA CRÔNICA

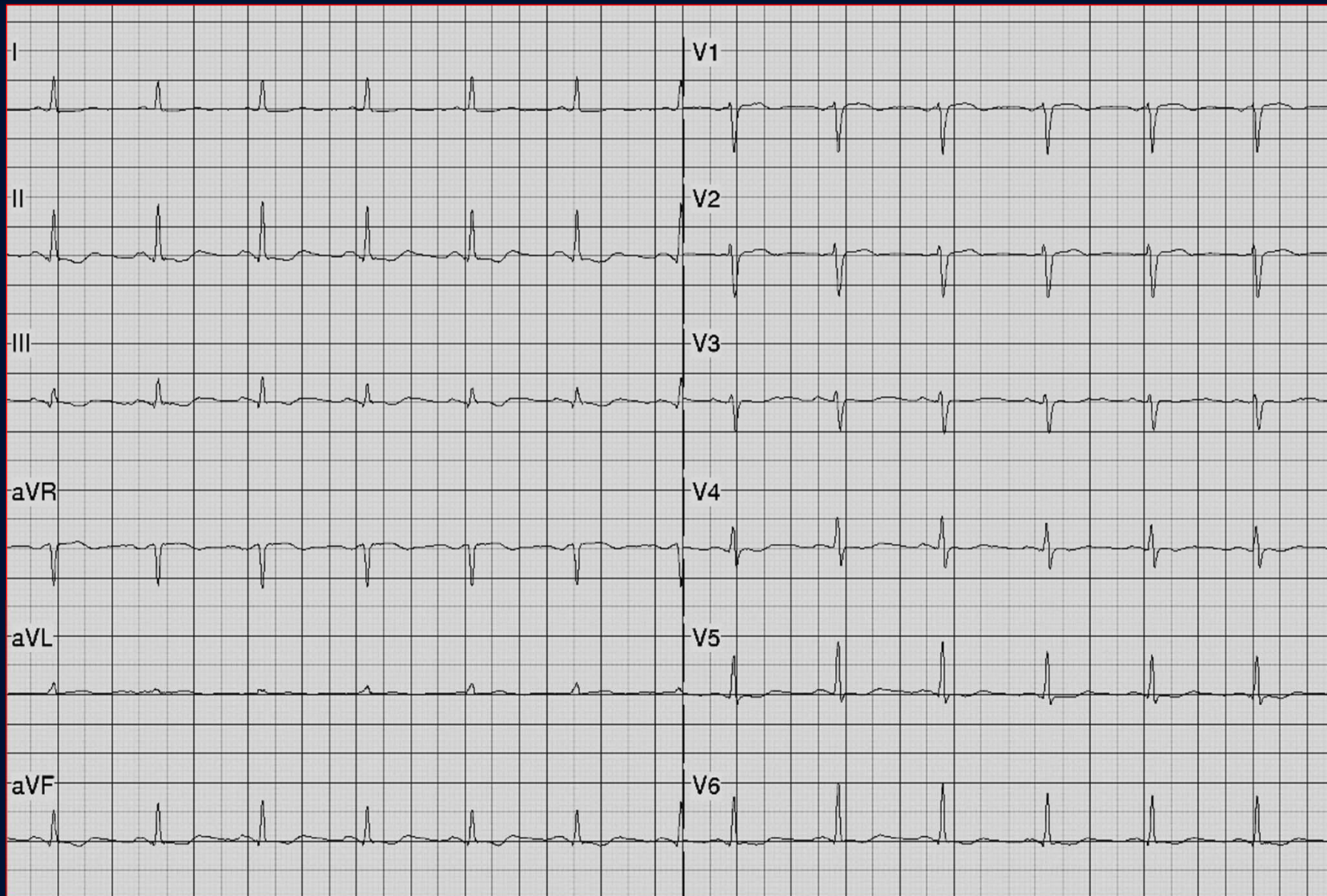
4. ATAQUE ISQUÊMICO TRANSITÓRIO / ACIDENTE CEREBROVASCULAR

5. DOENÇA RENAL CRÔNICA

6. INCAPACIDADE - ATIVIDADES DE VIDA DIÁRIA / < 5 MET (DASI)

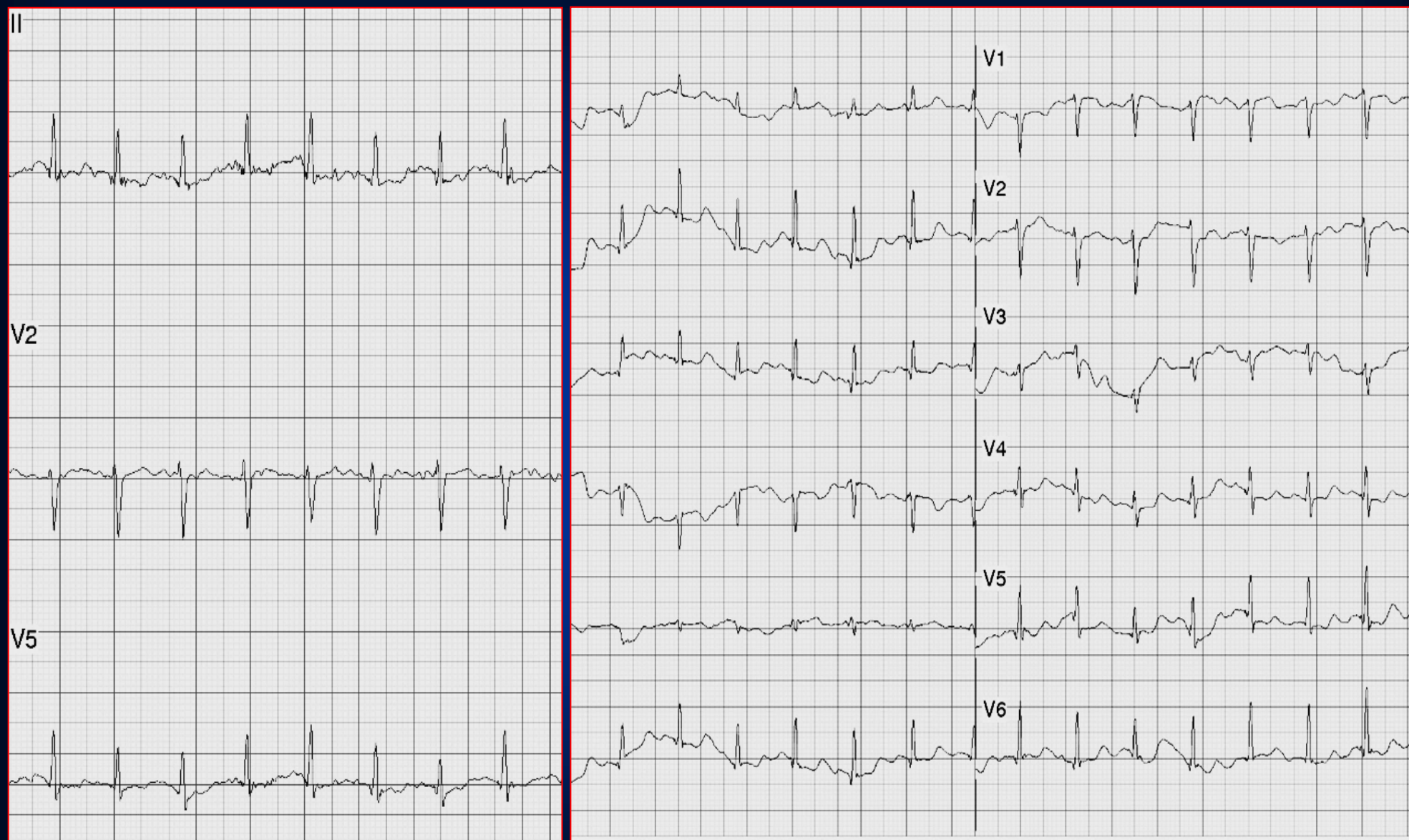
Mieres JH, Gulati M, Merz NB et al. AHA Cardiac Imaging Committee of the Council on Clinical Cardiology and the CVAS Imaging and Intervention Committee of the Council on Cardiovascular Radiology and Intervention. Role of noninvasive testing in the clinical evaluation of women with suspected ischemic heart disease: a consensus statement from the AHA. *Circulation*. 2014;130:350–379

**CENÁRIO 2 - 14/08/2014** IH 545430 IJKY, FEM, 72 a, IMC = 29,6; ATIVA,  
**CANSAÇO HÁ 20 DIAS AOS ESFORÇOS + DESCONFORTO PC / RETROESTERNAL**



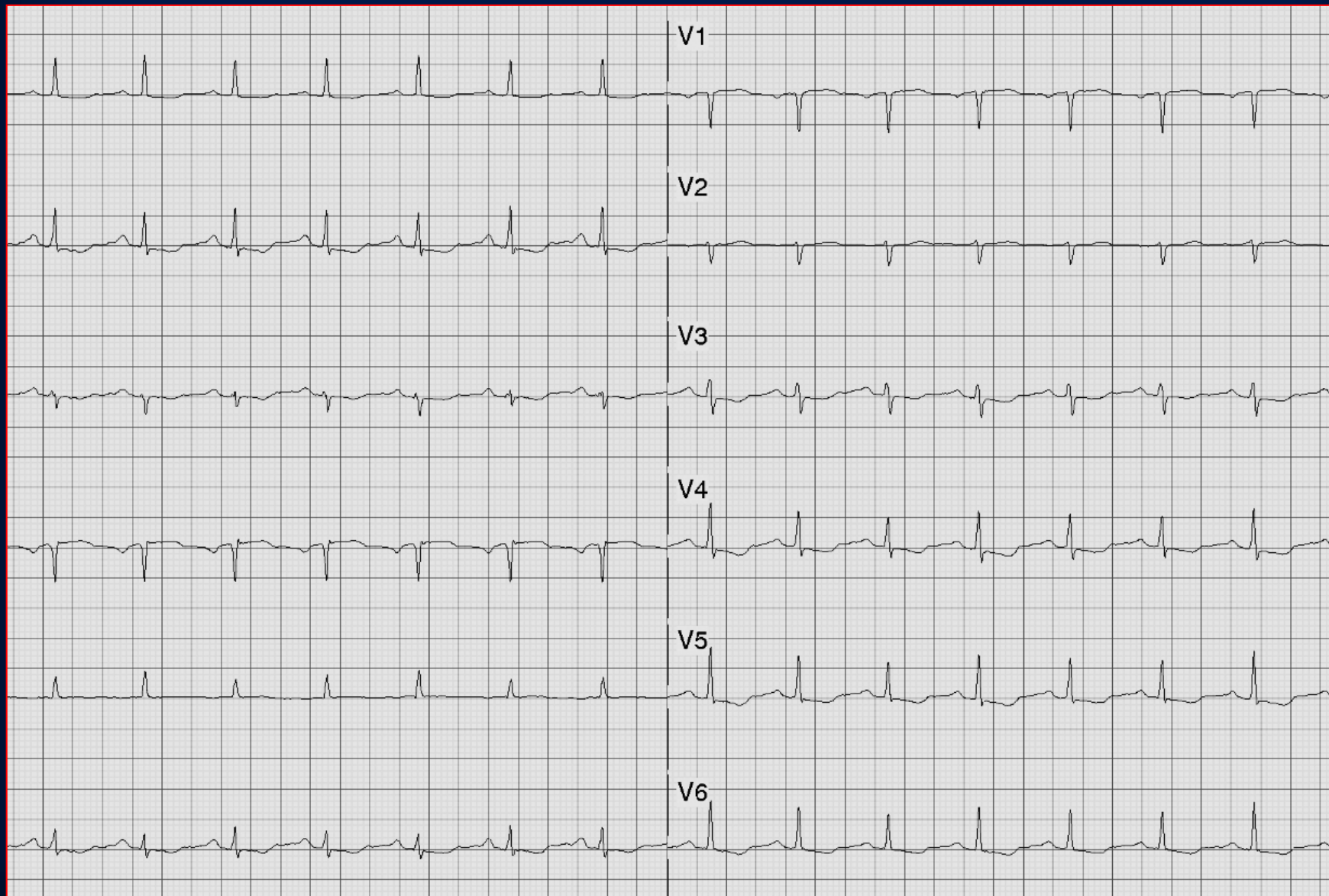
**HAS** – (VALSARTAN, HCTZ, ANLO), EUTHIROX, EFEXOR, STILNOX, **AF+**, **CATE HÁ ANOS (SIC)** - CT EM 8/08/2014,  
PROVAS FUNCIONAIS (TE + CPM HÁ UM ANO – NORMAL – sic ).

14/08/2014 IH 545430 IJKY, Fem, 72 a. BRUCE MODIFICADO, ETAPA II, 5.26 min, 2,7 Km.h/ 10%;

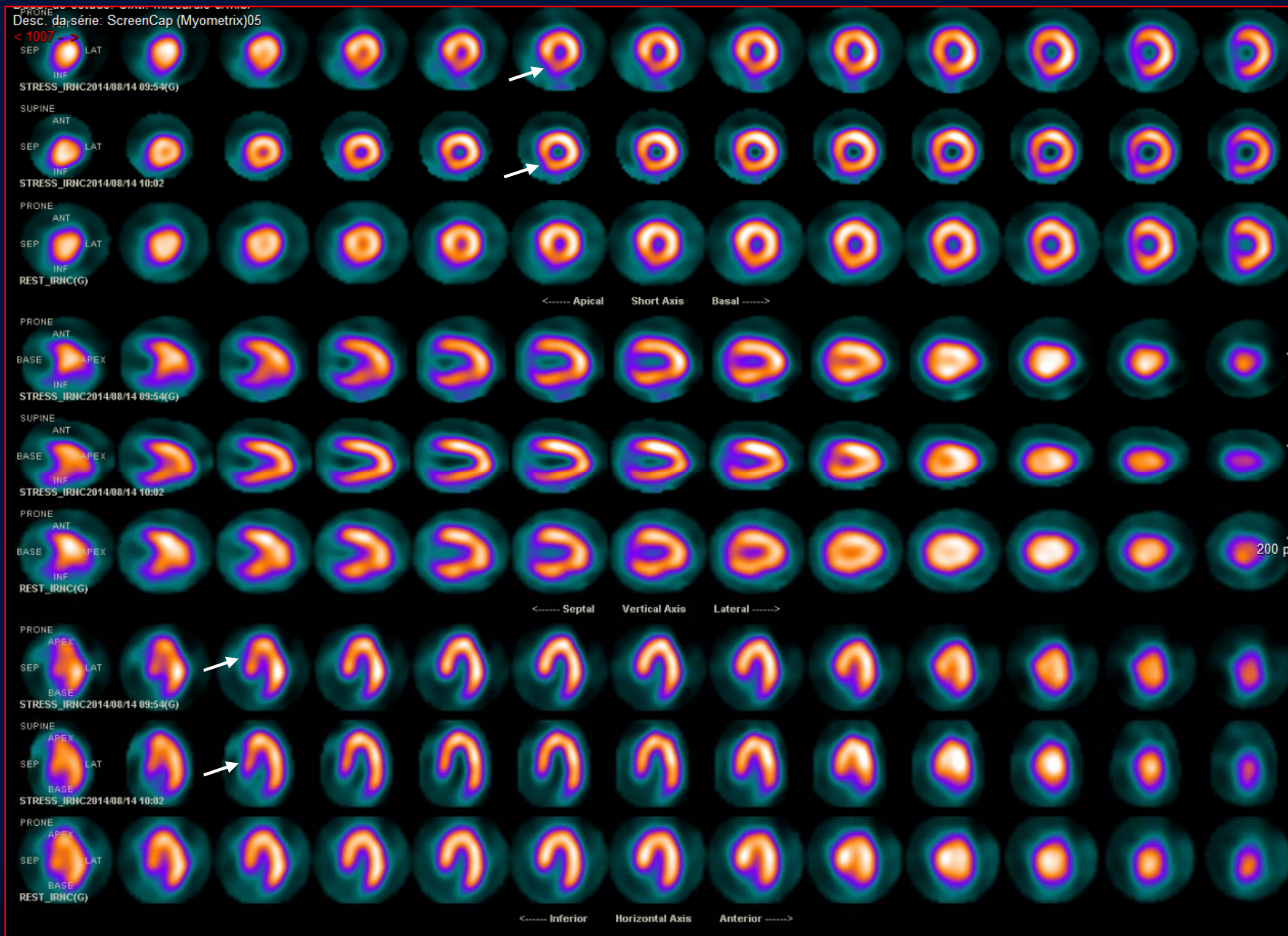


PAR = 125/48 mmHg; PA1 = 142/56 mmHg; FCR = 79 bpm; FC pico = 127 bpm (86% Máx) – **DOR PC**

14/08/2014 - IH 545430 IJKI, FEM., 73 a. - BRUCE - RECUPERAÇÃO 7 MIN. FC = 100 bpm



14/08/2014 - IJKI, FEM., 72 a. - <sup>99m</sup>Tc - MIBI - PROTOCOLO DE UM DIA



08/08/2014 IH 545430 IJKY, Fem, 72 a, IMC = 29,6; ATIVA, CANSAÇO HÁ 20 DIAS AOS ESFORÇOS

VARIÁVEIS	MEDIDAS	REFERÊNCIA
SEPTO - DIÁSTOLE	8	7.0 - 11.0 mm
P. POST. - DIÁSTOLE	8	7.0 - 11.0 mm
VE - DIAM. DIASTÓLICO	52	35 – 56 mm
VE - DIAM. SISTÓLICO	35	26 – 40 mm
ÁTRIO ESQUERDO	42	25 - 40 mm
FRAÇÃO ENCURT.	32%	28 - 42 mm
FRAÇÃO EJEÇÃO	60%	50 – 75%
MASSA DIAST. VE	143 g	< 198 g
ÍNDICE MASSA VE	82 g.m <sup>2</sup>	95 g.m <sup>2</sup>

*Redução da FD do VE e VD tipo redução do relaxamento. Pressão de enchimento do VE aumentada  $E/E' = 9,9$  ( $nl < 8$ ). Insuficiência Mi e Ao mínimas. PSVD = 30mmHg.*

▶ *Durante manobra de esforço isométrico - sinais de isquemia transitória:*

▶ *Hipocinesia septal anterior discreta. Hipocinesia da parede inferior de grau moderado.*

Cálcio = 231

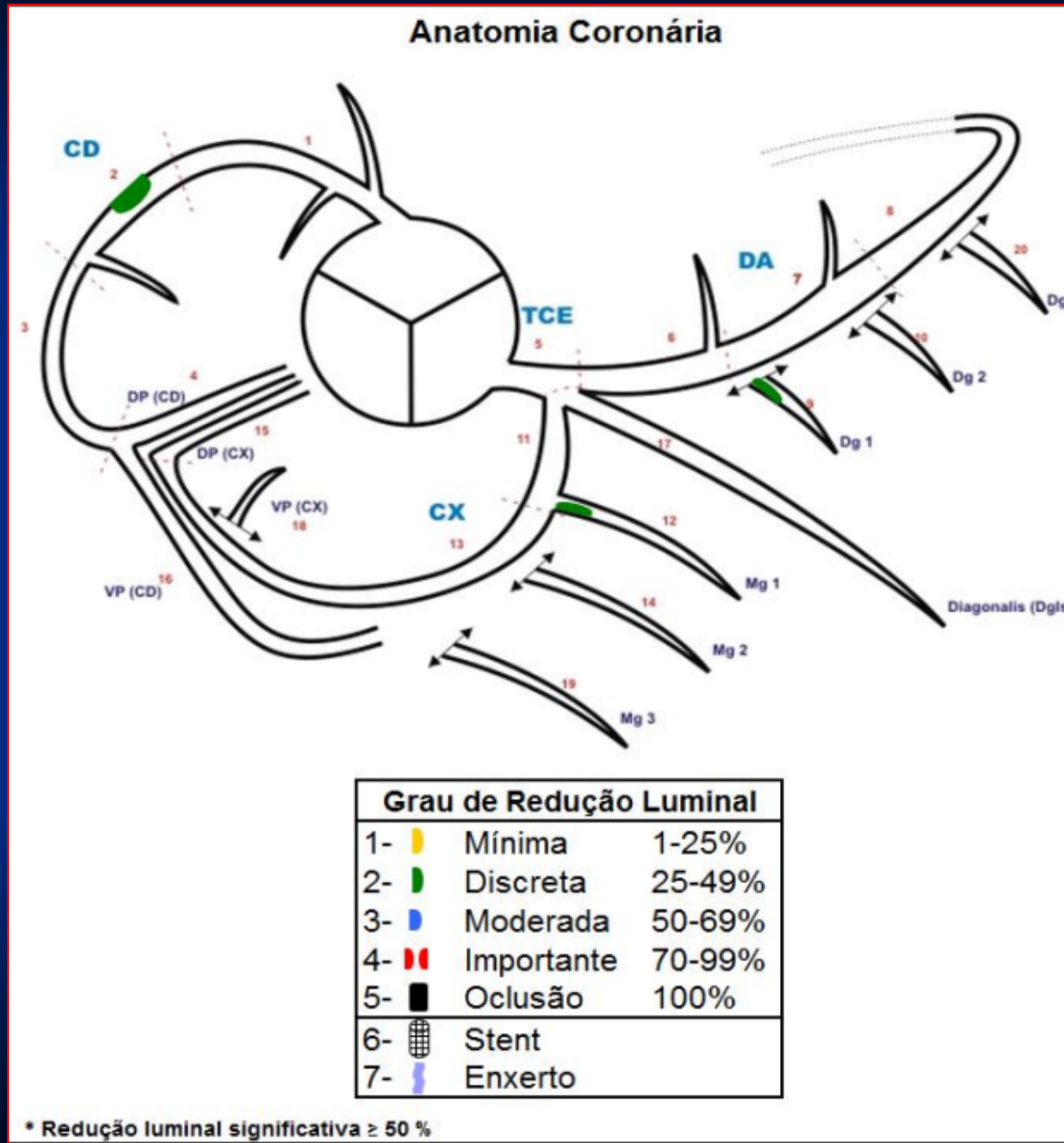
% = 80%

♥ *Ponte miocárdica*  
*1/3 médio DA;*

♥ *DG1 - discreta;*

♥ *Mg1 - discreta;*

♥ *CD - discreta*

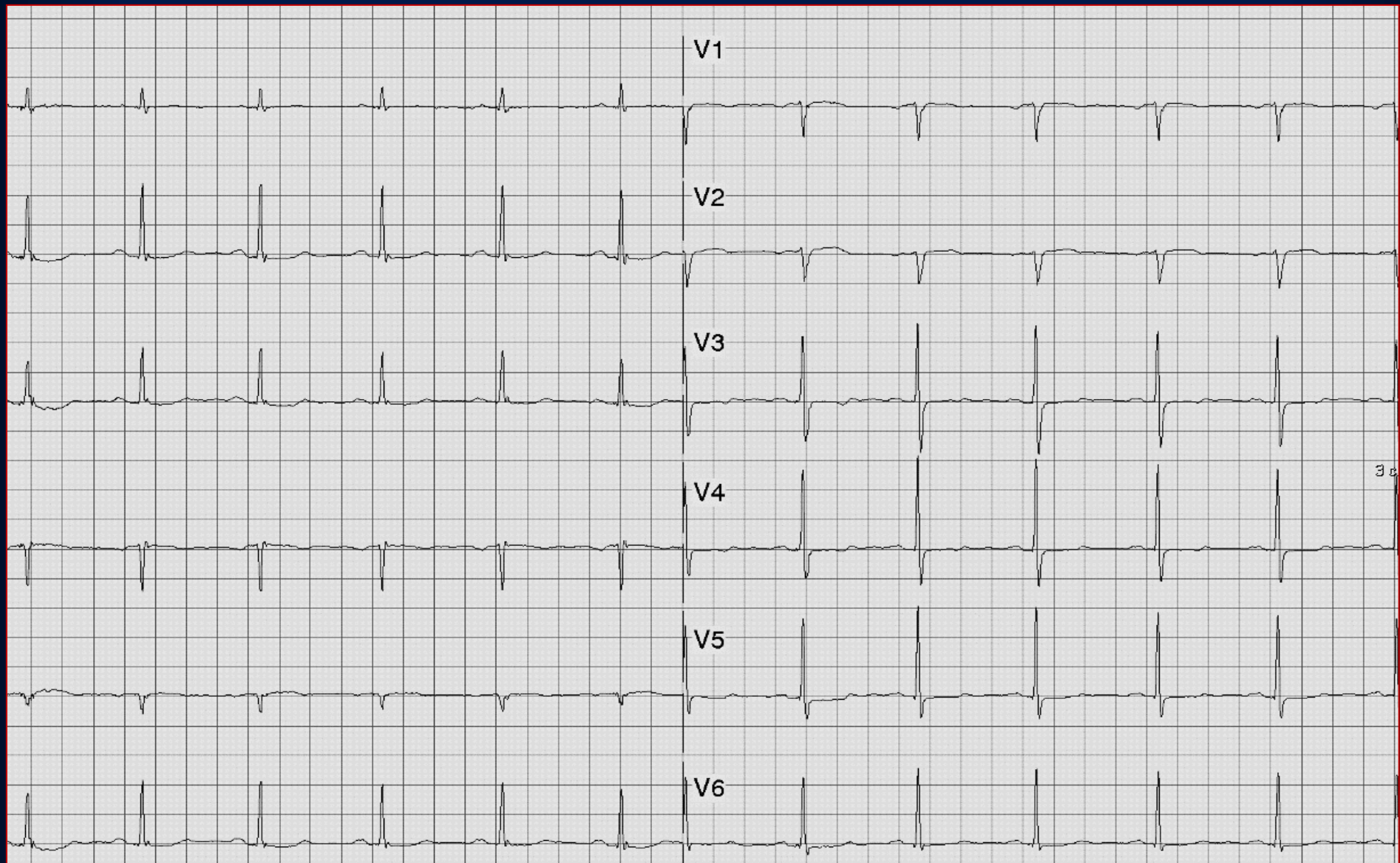


15/08/2014 IH 545430 IJKY, Fem, 72 a, CINE

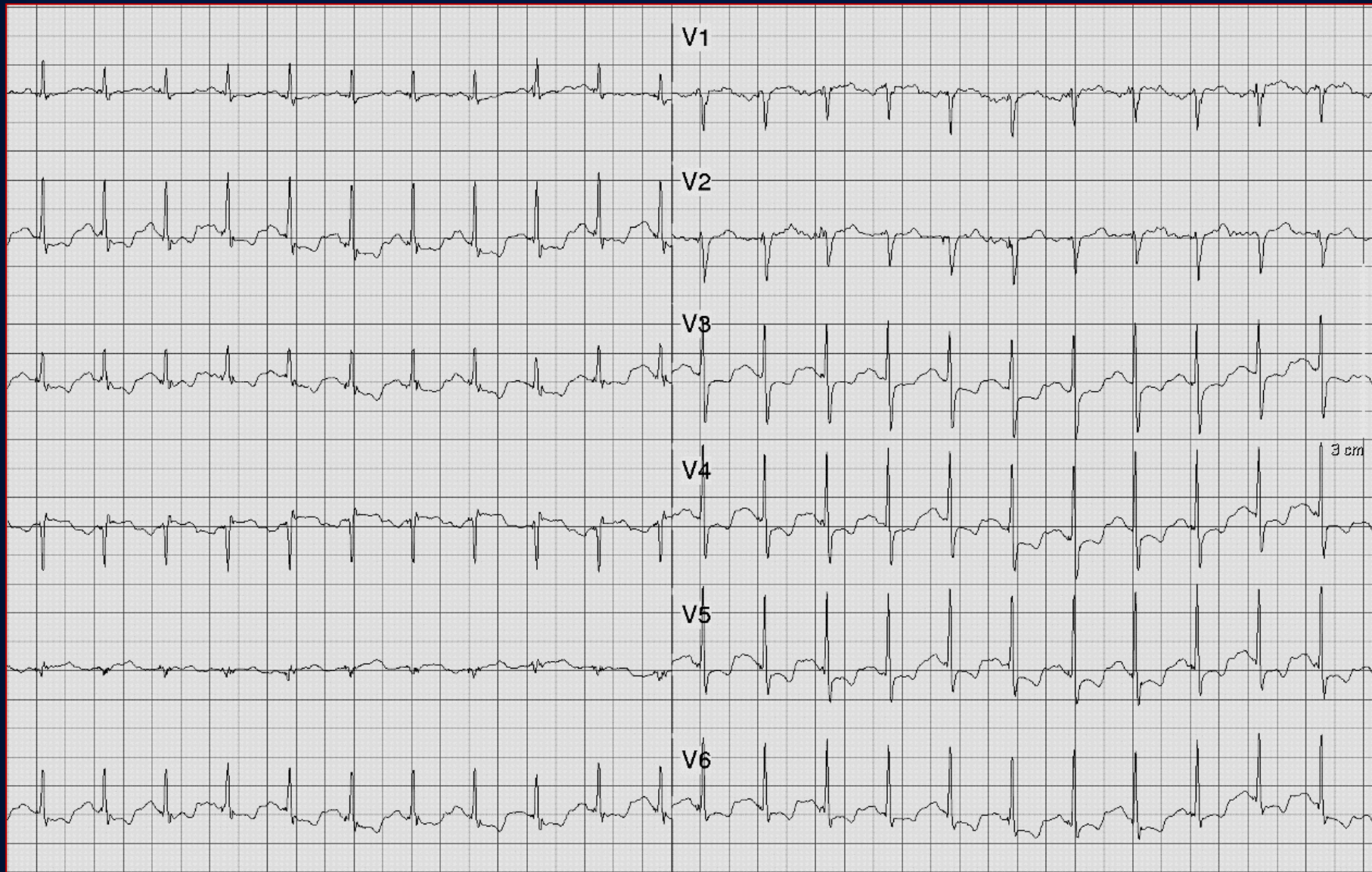




**CENÁRIO 3 - MILL, Fem, 65 a, 65 Kg, 1,63 m; Estresse, AF + (Pai/ Mãe); Synthroid - ECG R**

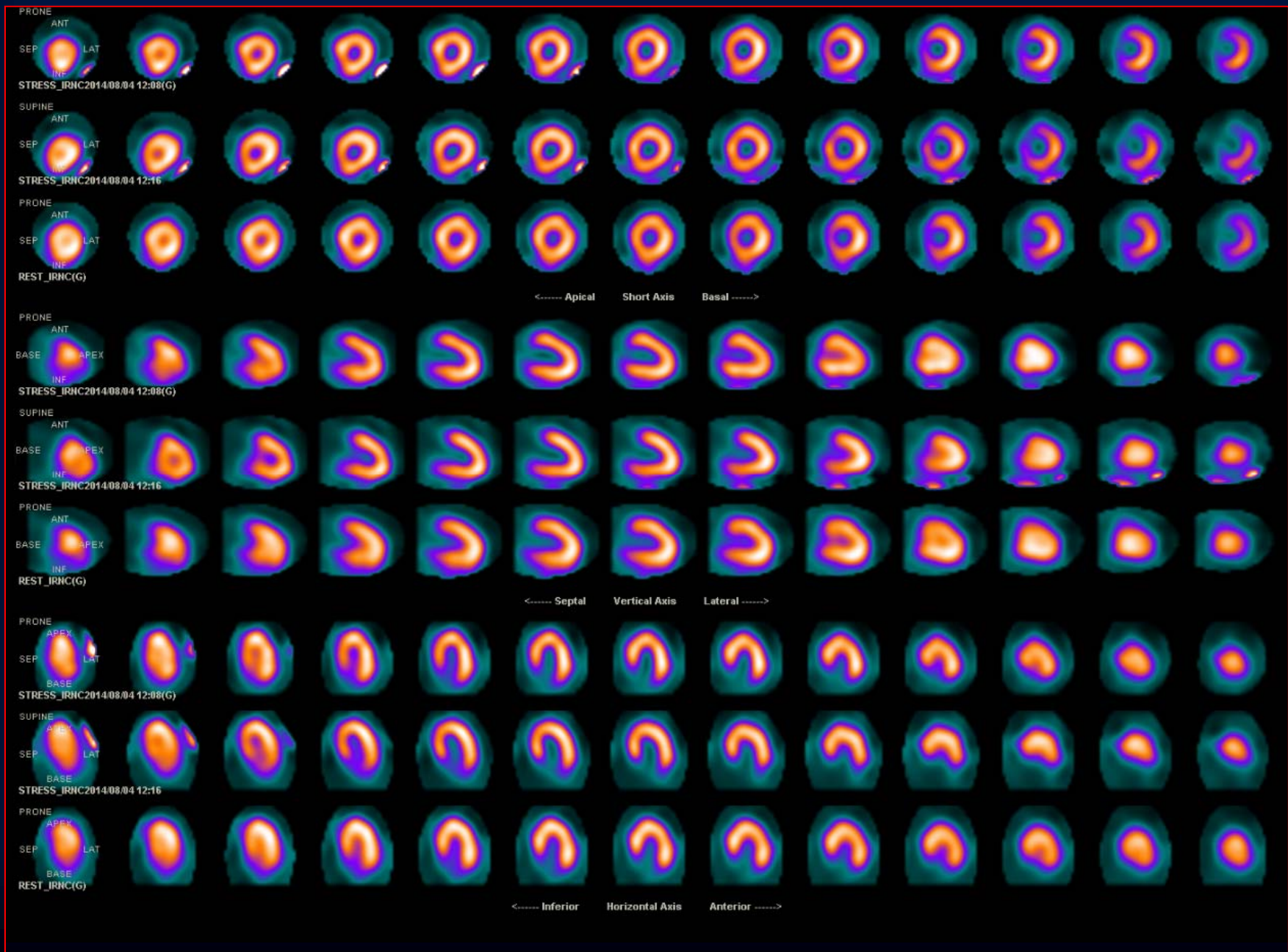


**CENÁRIO 4 - MILL, 65 a, Fem, BRUCE , 10 min, ETAPA IV; PA Pico = 152/78 mmHg; FC = 145 bpm**



IH 4371011 - 4/08/2014 **FCR** = 76 bpm **PAR** = 119/76 mmHg **FC** MIBI = 140 bpm (90,3%) **FC** Máx = 155 bpm;

IH 4371011 MILL, Fem, 65 a, FC MIBI = 140 bpm (90,3% Máx), Bruce 10 min, IV Etapa



3

RECUPERAÇÃO da FC APÓS a FASE de ESFORÇO  
do TE (MINUTOS 1 e 2) - QUEDA < 12 e < 22 bpm

4

RESPOSTA CRONOTRÓPICA - ÍNDICE CRONOTRÓPICO < 0,80



VALOR PROGNÓSTICO PARA EVENTOS

*Lauer M et al. JAMA 2000; 284 (11):1392-8; Lancet 2002; 360 (9340):1176-7; Diabetes Care 2003; 26(7): 2052-7; J Am Coll Cardiol 2003; 42(5):831-8; Georgoulas et al. Nucl Med Commun 2007; 28(3):165-71; Myers J et al. Eur J CVAS Prev Rehabil 2007; 14(2):215-21; Leeper NJ et al. Circulation 2007; 115(4):468-74 ; Guazzi M, Myers J et al .J Cardiopulm Rehabil Prev. 2010; Curtis JM, Diabetes Care. 2010; Gulati M, Shaw LJ et al. Circulation. 2010;122:130–137.Arbit B, Azarbal B, Hayes SW et al . Am J Cardiol. 2015; 1;116(11):1678-84.*

## **MARCADORES DE ALTO RISCO**

- ▶ **CAPACIDADE FUNCIONAL**
- ▶ **SINTOMAS**
- ▶ **FENÔMENOS ECG - DESVIOS ST**

**INÍCIO, MAGNITUDE, ASPECTO MORFOLÓGICO  
DURAÇÃO, NÚMERO DE DERIVAÇÕES**

- ▶ **ARRITMIAS - COMPLEXIDADE e MOMENTO**
- ▶ **CRONOTROPISMO - IC + RECUPERAÇÃO DA FC**
- ▶ **PRESSÃO ARTERIAL SISTÓLICA**
- ▶ **ESCORES PROGNÓSTICOS**

*Meneghelo RS, Araújo CGS, Stein R, Mastrocolla LE, Albuquerque PF, Serra SM et al. SBC. III Diretrizes da SBC sobre TE. Arq. Bras. Cardiol. 2010; 95(5; 1):1-26; Fletcher GF et al. On behalf of the AHA Exercise, Cardiac Rehabilitation, and Prevention Committee of the Council on Clinical Cardiology, Council on Nutrition, Physical Activity and Metabolism, Council on CVAS and Stroke Nursing, and Council on Epidemiology and Prevention. Exercise standards for testing and training: a scientific statement from the AHA. Circulation. 2013; 128:873-934.*

# DIAGNÓSTICO - DAC



CANDIDATOS -TE  
APTOS AO EXERCÍCIO COM BOA CF PREDITA  
ECG REPOUSO NORMAL

SIM



TE



Baixa Prob Pós



Modificação FR

NÃO



Intermediária / alta  
Prob Pós



SPECT, PET, CT, RMC



Baixa Prob Pós



Modificação FR

ANORMAL



SPECT PARA ESTENOSES  
INDETERMINADAS NA ANGIO CT  
GRAVIDADE CARGA ISQUÊMICA  
CINE PARA PT SELECIONADOS  
PET + CFR - IDENTIFICAR DEFEITOS  
PERFUSIONAIS QUE NÃO  
NECESSITEM CINE

FFR

# UTILIZAÇÃO DO TE SEM IMAGEM COMO ÍNDICE DIAGNÓSTICO

*Sintomáticas, Risco Intermediário, ECG de base dentro dos limites normais*

**1** - *Avaliação da Capacidade de Trabalho em mulheres funcionalmente capazes de exercitarem-se;*

**2** - *Pacientes que atingem < 5 METs estão em risco aumentado de morte e eventos relacionados, independente de FR tradicionais.*

**3** - *Elevado valor preditivo negativo do ECG de esforço;*

**4** - *Evidências recentes de desfechos clínicos semelhantes em dois anos de seguimento para mulheres randomizadas TE x CPM.*

Shaw LJ, Mieres JH, Hendel RH, Boden WE, Gulati M, Veledar E, Hachamovitch R, Arrighi JA, Merz CN, Gibbons RJ, Wenger NK, Heller GV; for the WOMEN Trial Investigators. Comparative effectiveness of exercise electrocardiography with or without myocardial perfusion SPECT in women with suspected CAD: results from the What Is the Optimal Method for Ischemia Evaluation in Women (WOMEN) trial. *Circulation*. 2011;124:1239-1249.