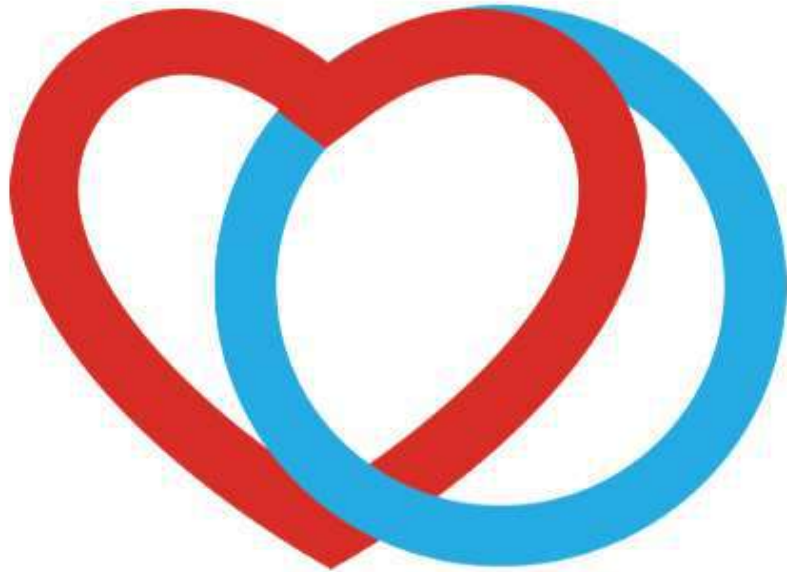


XIV CONGRESSO AMD MOLISE

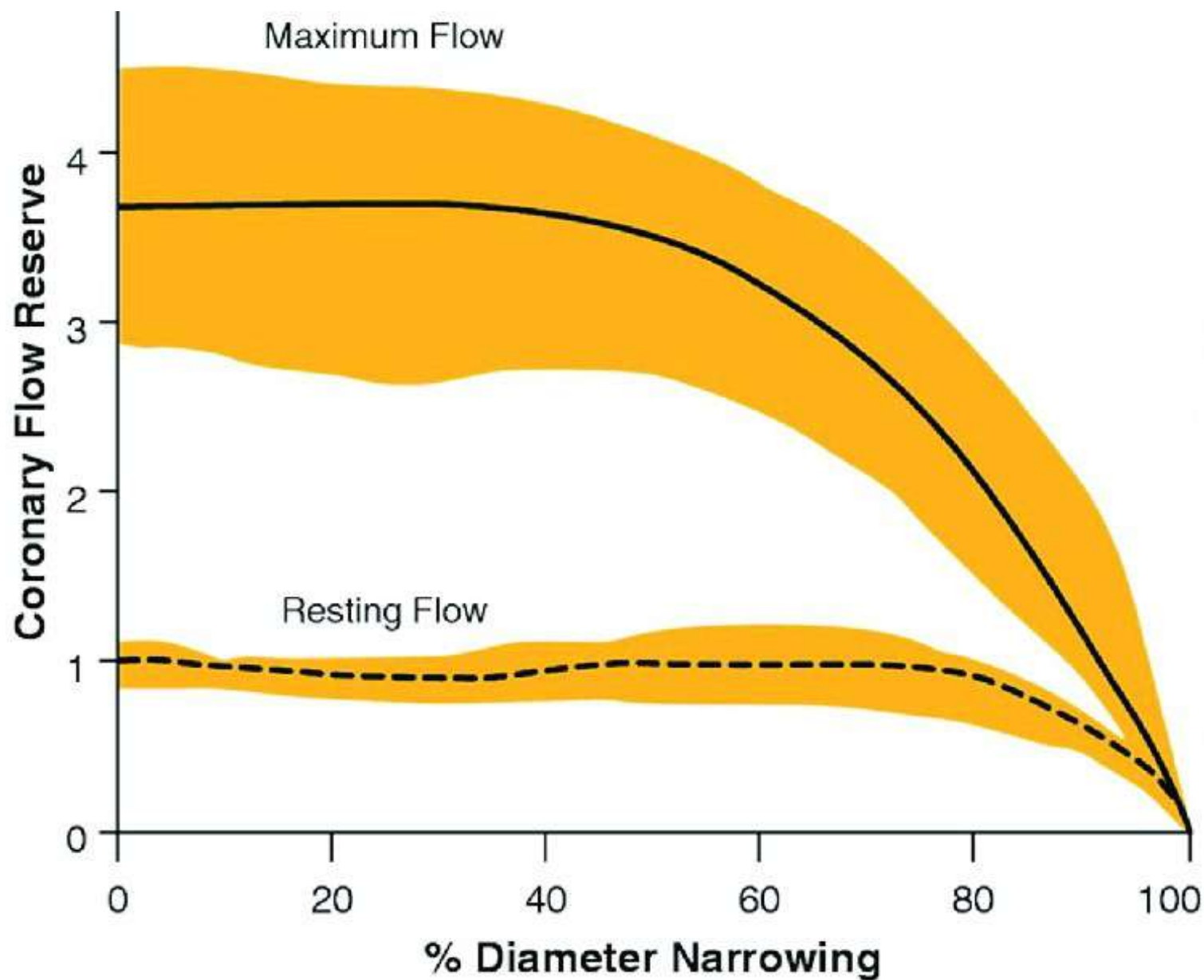


CAMPOBASSO, 11 DICEMBRE 2021
Hotel Centrum Palace



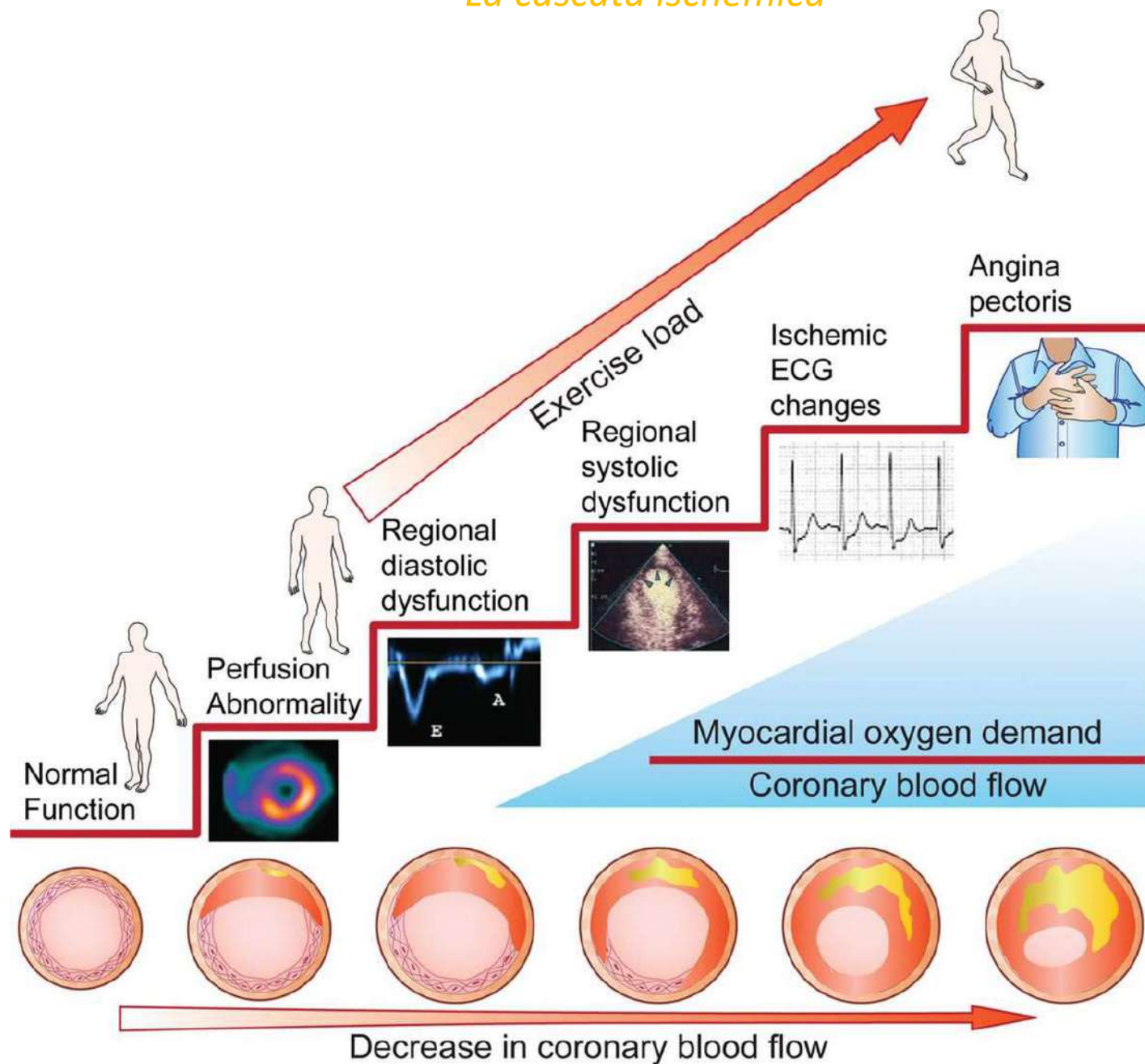
*Il ruolo dell'ecostress nella
cardiopatía ischemica del
paziente diabetico*

Antonio Totaro
MD, PhD Student
UOC Cardiologia
Gemelli Molise



Fisiopatologia dell'ischemia miocardica

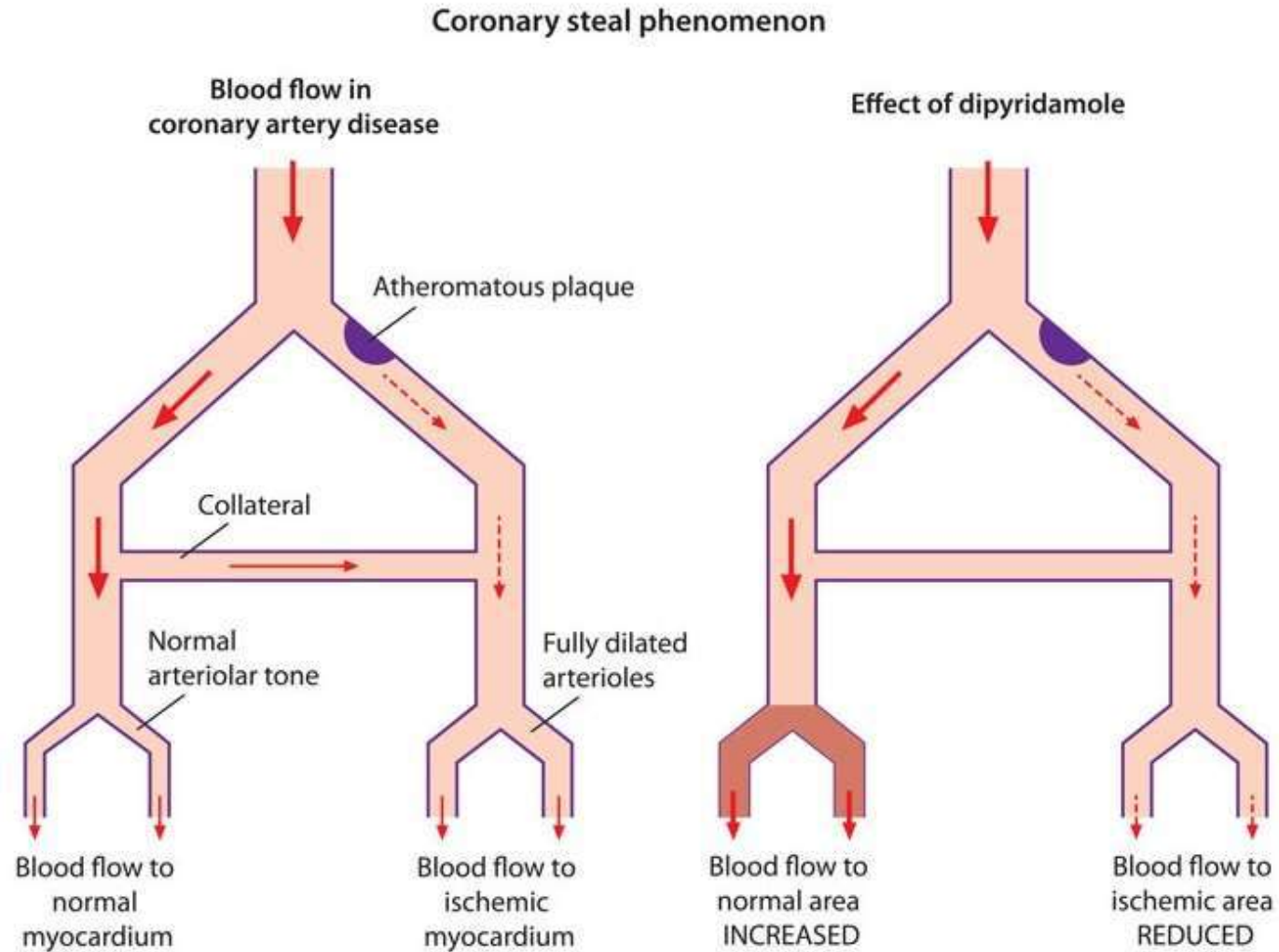
La cascata ischemica



Fisiopatologia dell'ischemia miocardica

I meccanismi dell'ischemia

1. Furto coronarico per mal distribuzione del flusso: DIPYRIDAMOLO



Fisiopatologia dell'ischemia miocardica

I meccanismi dell'ischemia

2. Aumentata richiesta di ossigeno:

- a. ESERCIZIO*
- b. PACING*
- c. DOBUTAMINA*

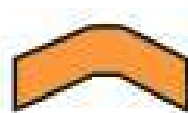


Criteri diagnostici

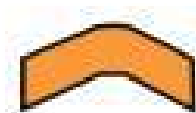
Stress Echocardiography in 4 equations

Rest

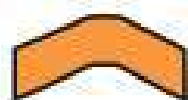
Stress



Normal



Ischemia



Viability



Necrotic



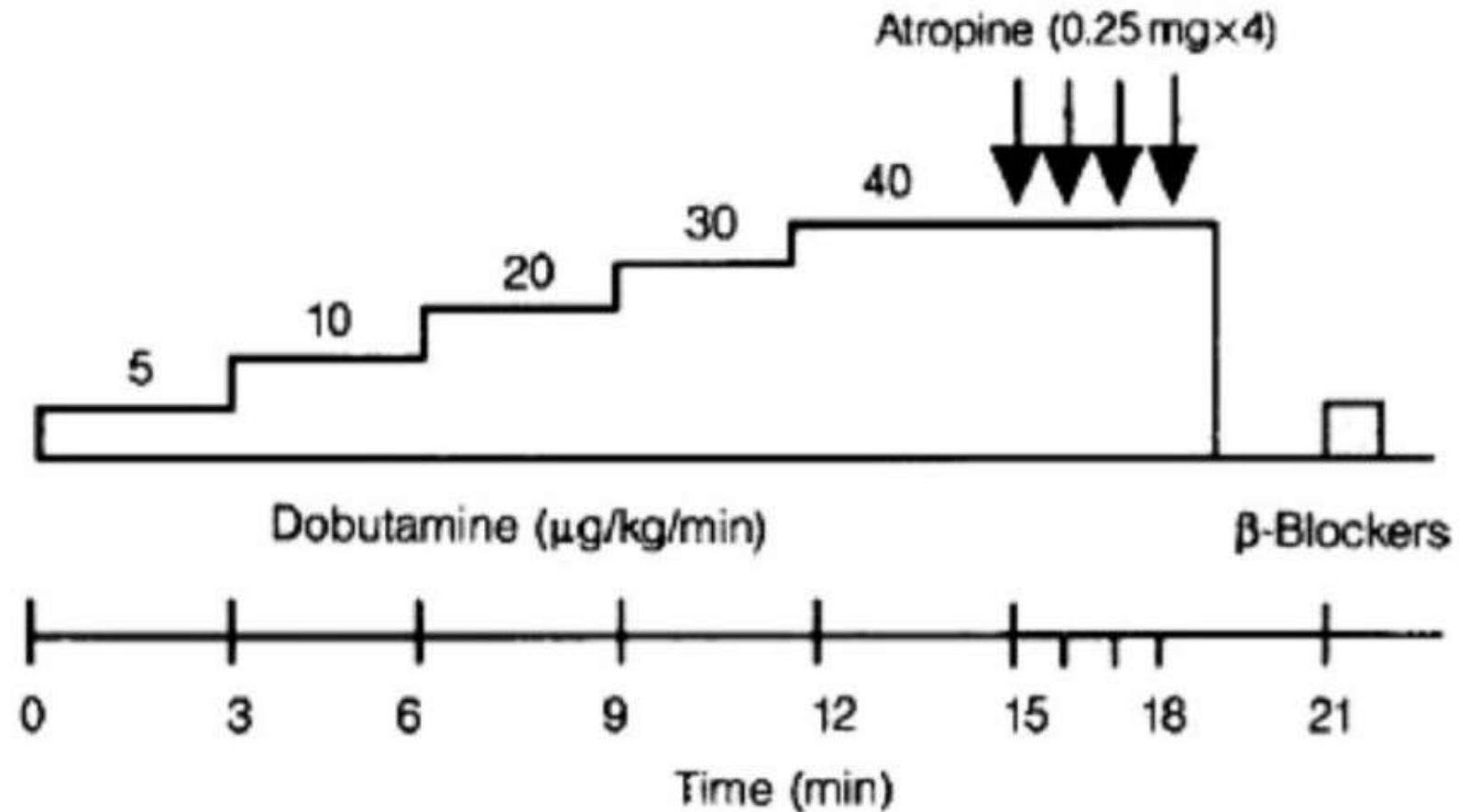
Endpoints diagnostici

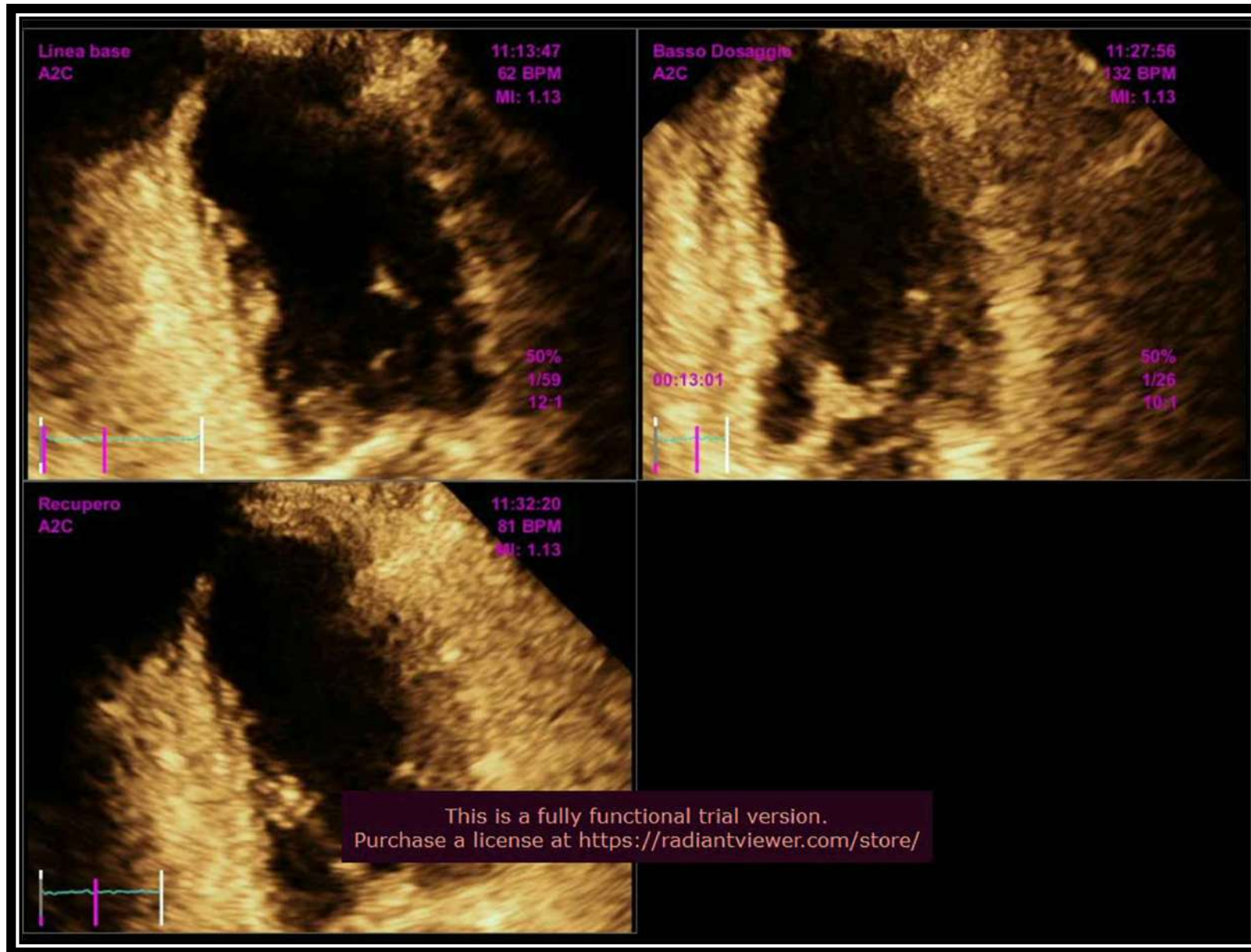
- *Carico lavoro massimale (per ecostress fisico) e massima dose farmaco*
 - *Raggiungimento della FC target*
 - *Acinesia in > 2 segmenti miocardici*
 - *Angina severa*
 - *Sottoslivellamento ST > 2 mm*
- *Ipertensione (PAS>220, PAD>120)*
 - *Ipotensione (>40 mmHg)*
 - *Aritmie SV o V*

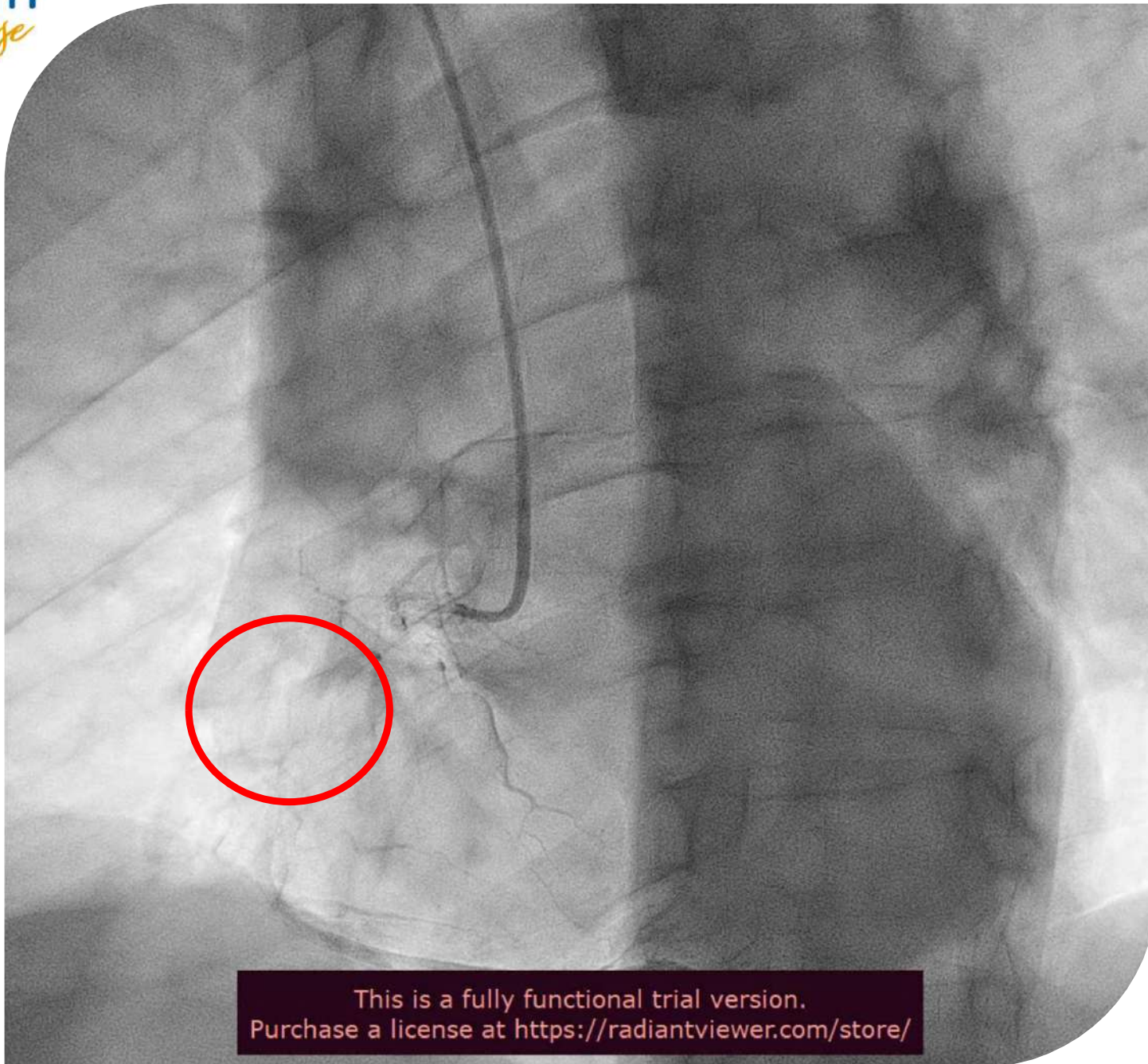


Protocolli

1. Dobutamina





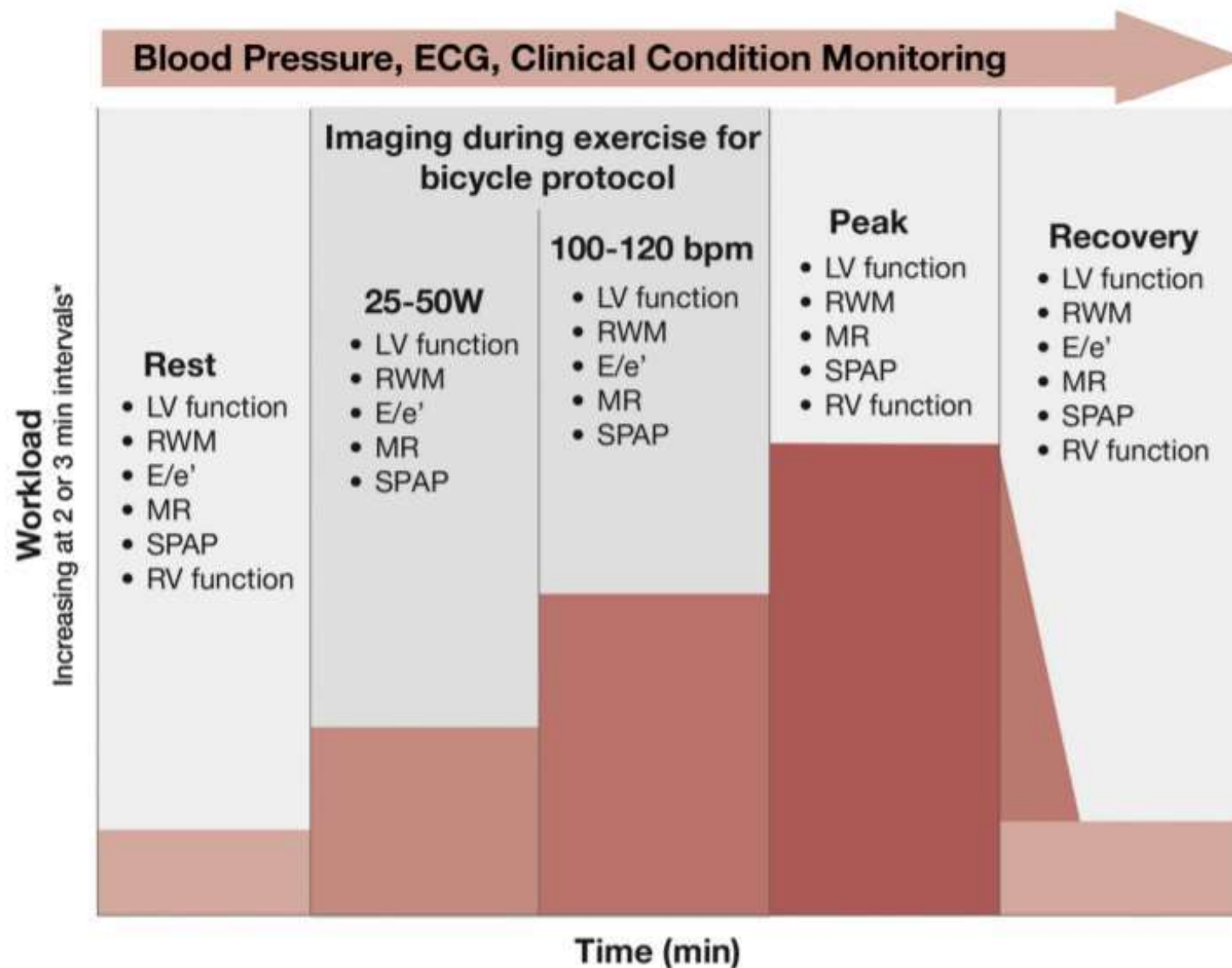


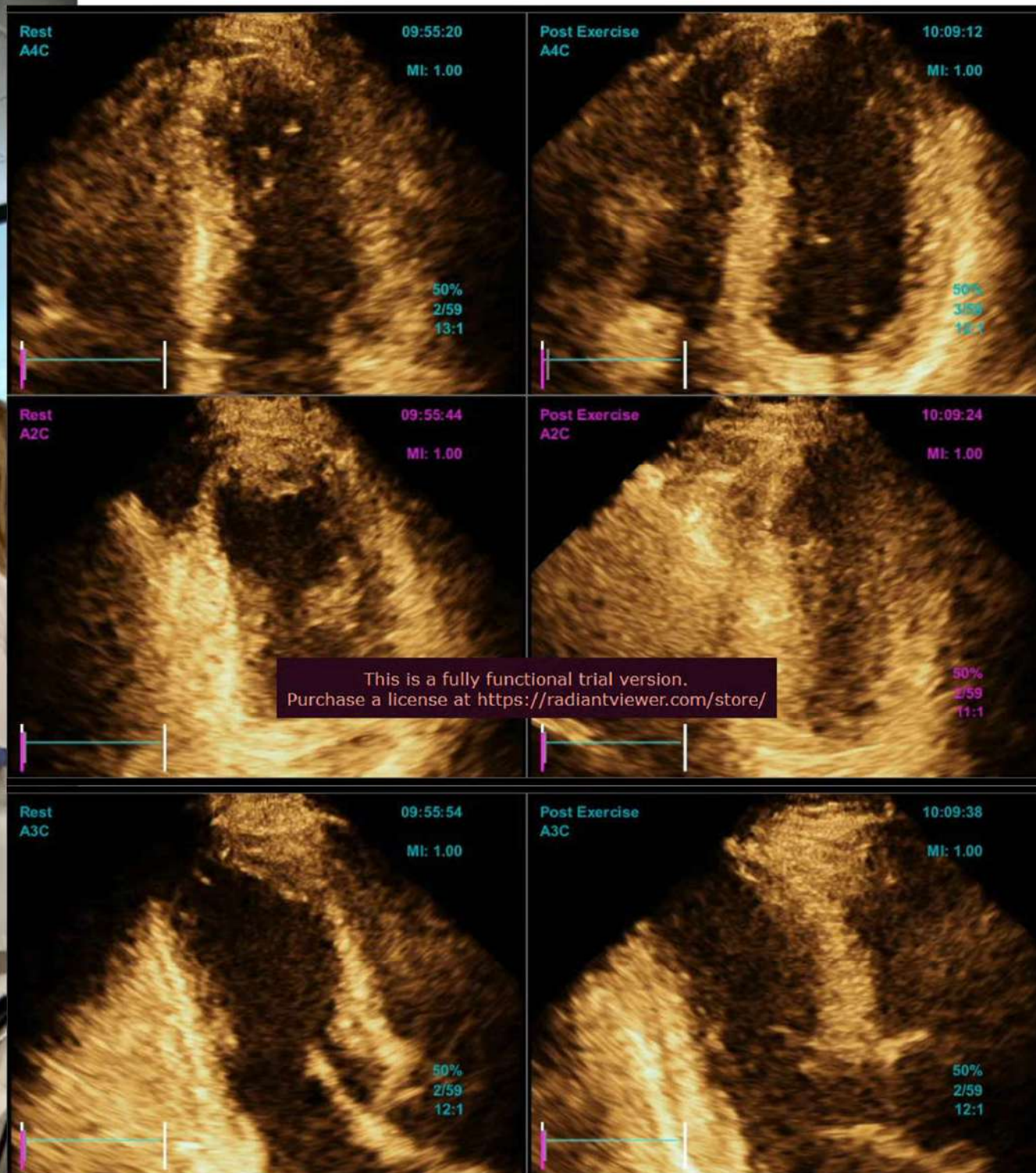
This is a fully functional trial version.
Purchase a license at <https://radiantviewer.com/store/>



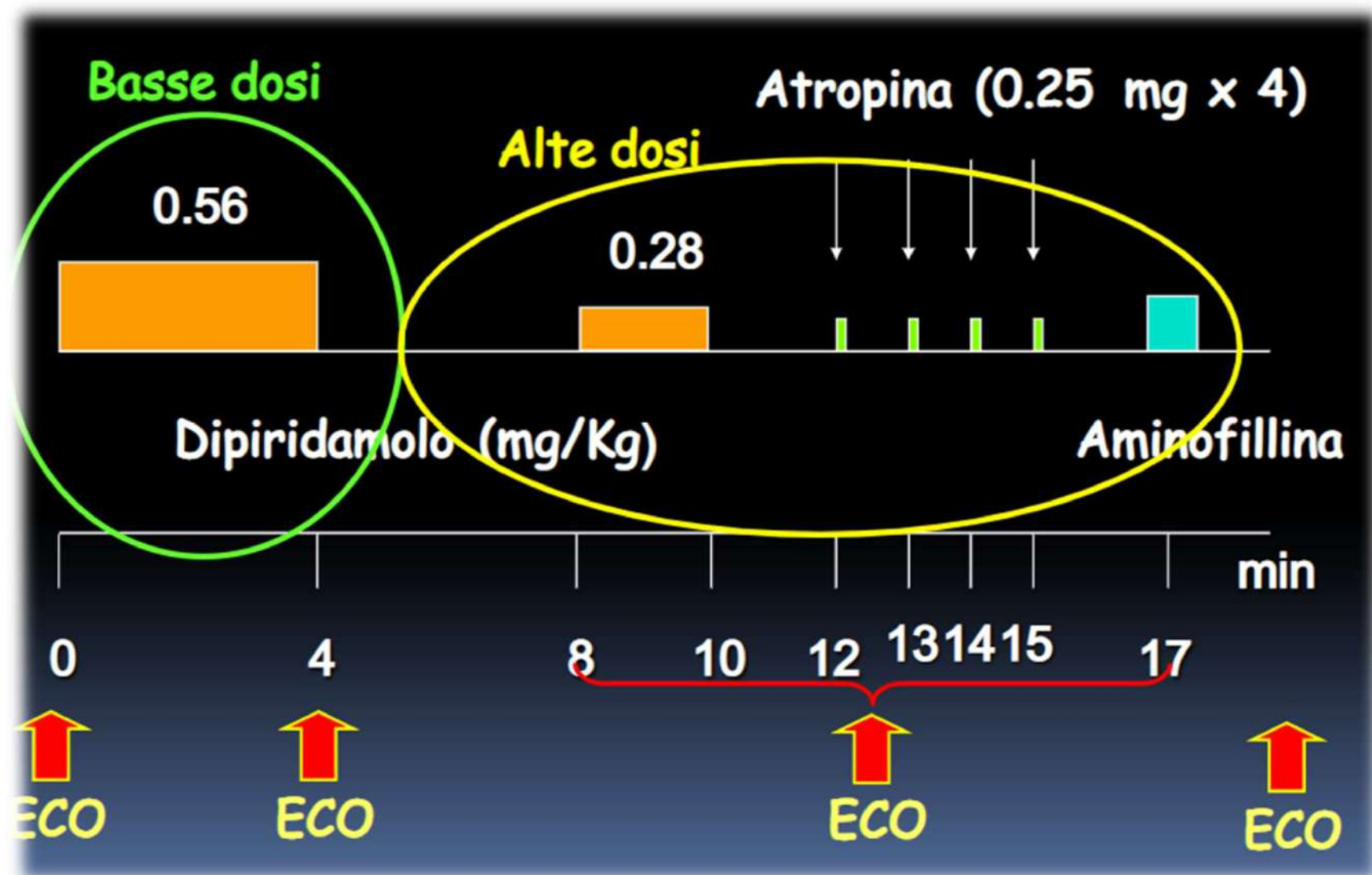
Protocolli

2. Esercizio



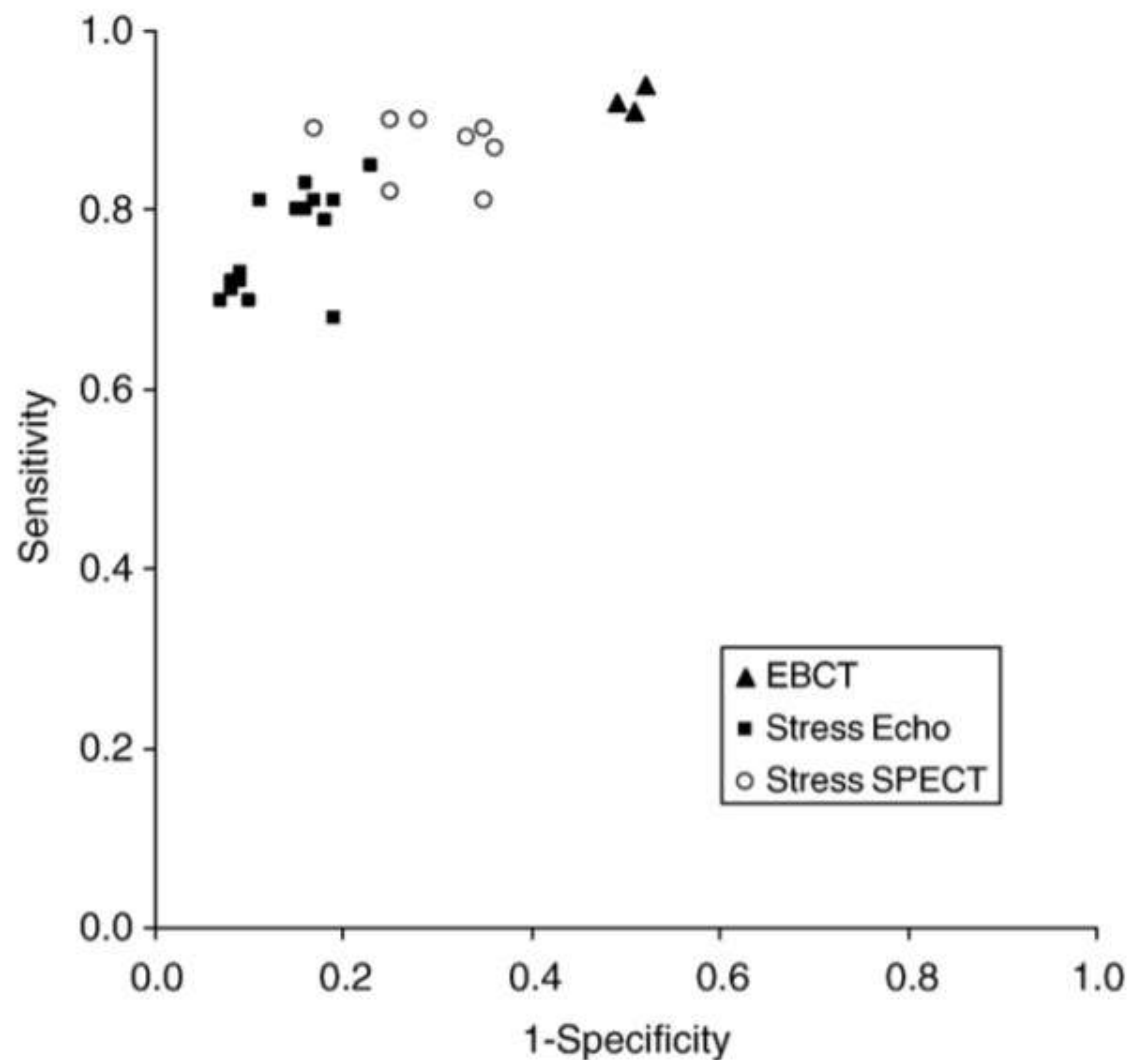


Protocolli
3. Dipyridamolo



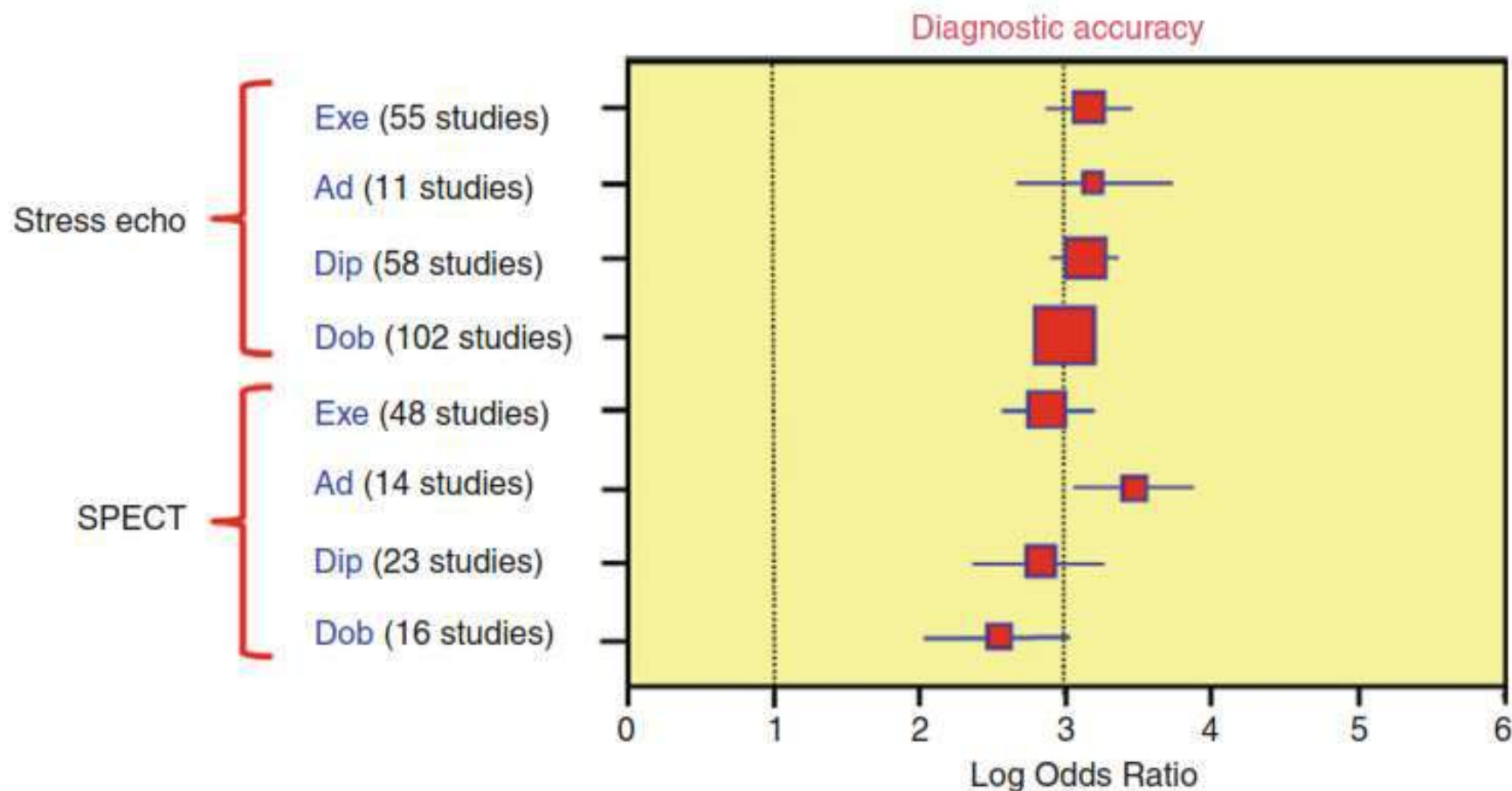
Accuratezza diagnostica

Metanalisi di 55 studi con 3.714 pazienti



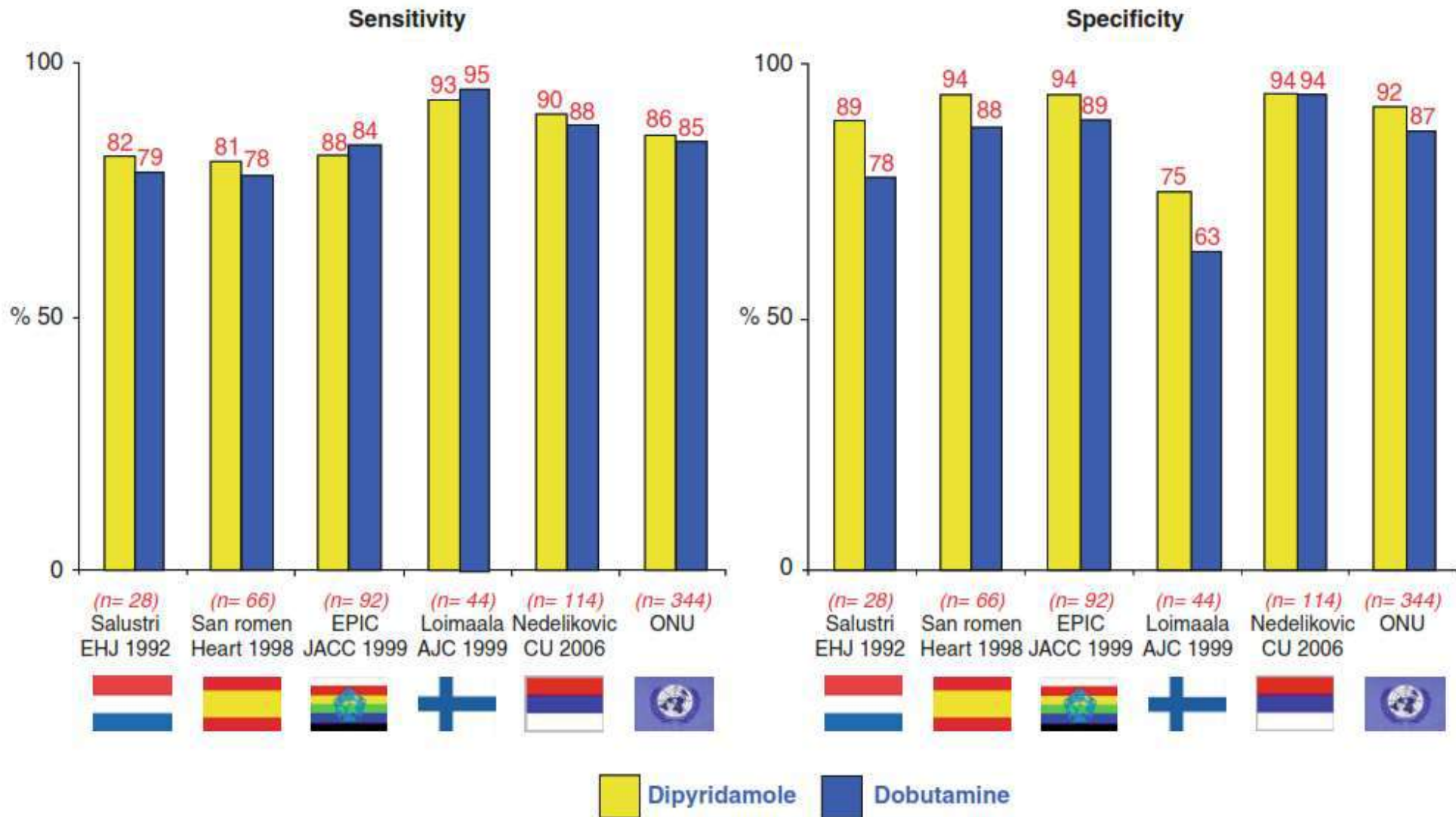
Accuratezza diagnostica

L'ecostress presenta simile accuratezza diagnostica rispetto alla scintigrafia miocardica



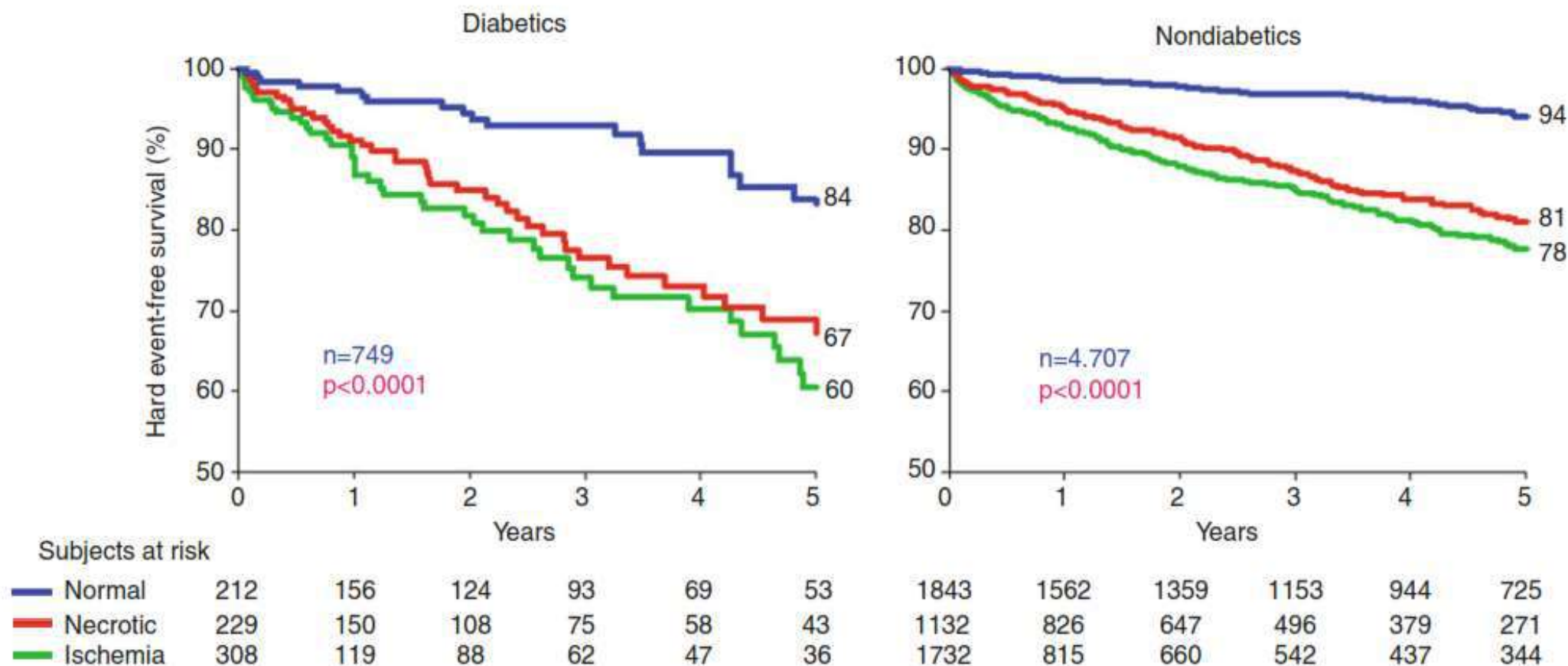
Accuratezza diagnostica (veri positivi+veri negativi)/num tot dei test eseguiti

La dobutamina e il dipiridamolo hanno
stessa sensibilità (84%) e simile specificità (87% vs 92%).



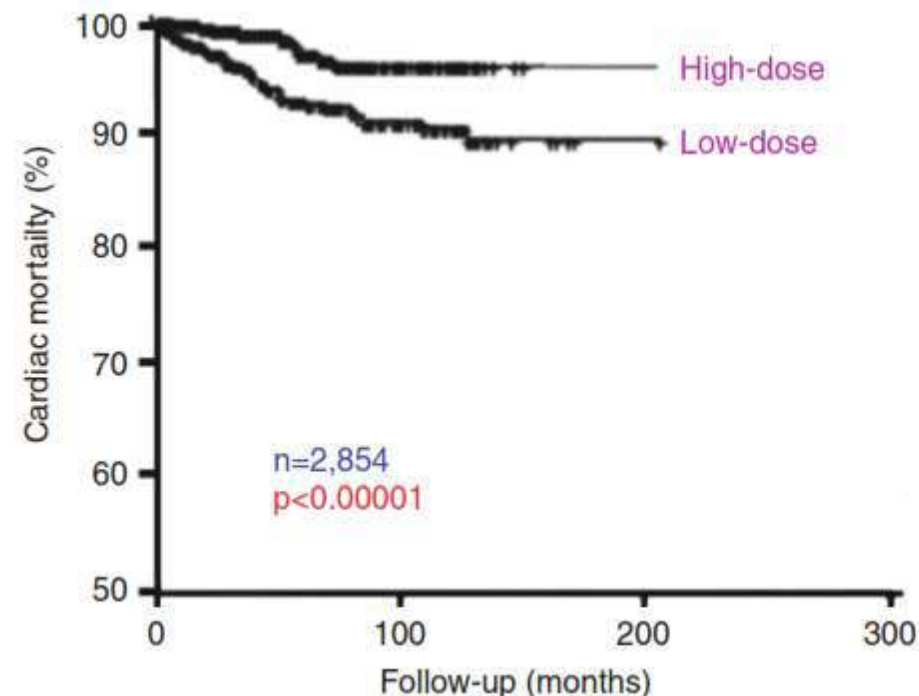
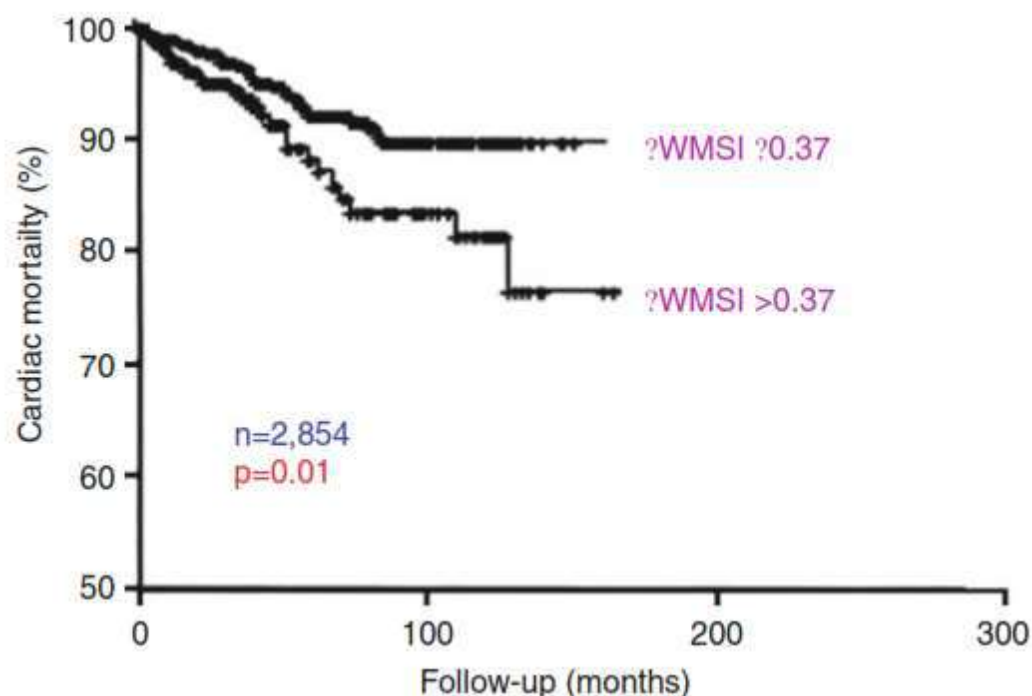
Valore prognostico

I pattern ischemico e necrotico sono associati ad un rischio aumentato di morte e infarto miocardico, mentre un test normale è predittivo di un outcome favorevole particolarmente nei pazienti non diabetici.



Valore prognostico

*La risposta ischemica può essere stratificata sulla base di parametri ecografici additivi come l'estensione delle anomalie della cinetica segmentaria, espressa dal **WMSI**, e dal **carico** di lavoro/dose farmaco a cui si verifica l'ischemia.*

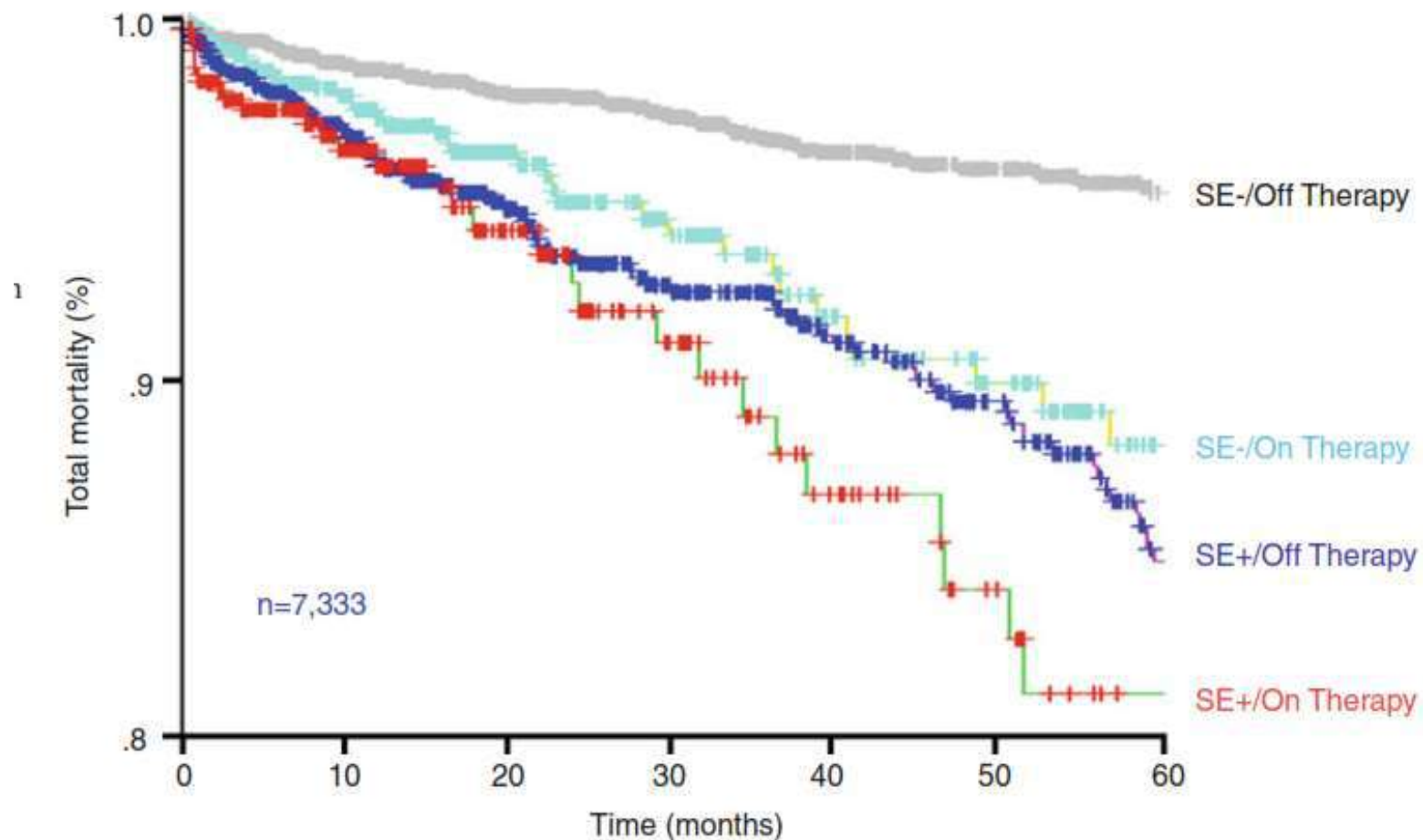


Sicari R, Pasanisi E, Venneri L, Landi P, Cortigiani L, Picano E. J Am Coll Cardiol. 2003;41:589–95.



Valore prognostico

La terapia anti-ischemica condiziona il valore prognostico del test. La presenza di ischemia miocardica inducibile in un paziente in terapia identifica un subset di pazienti a più alto rischio di eventi e di morte.



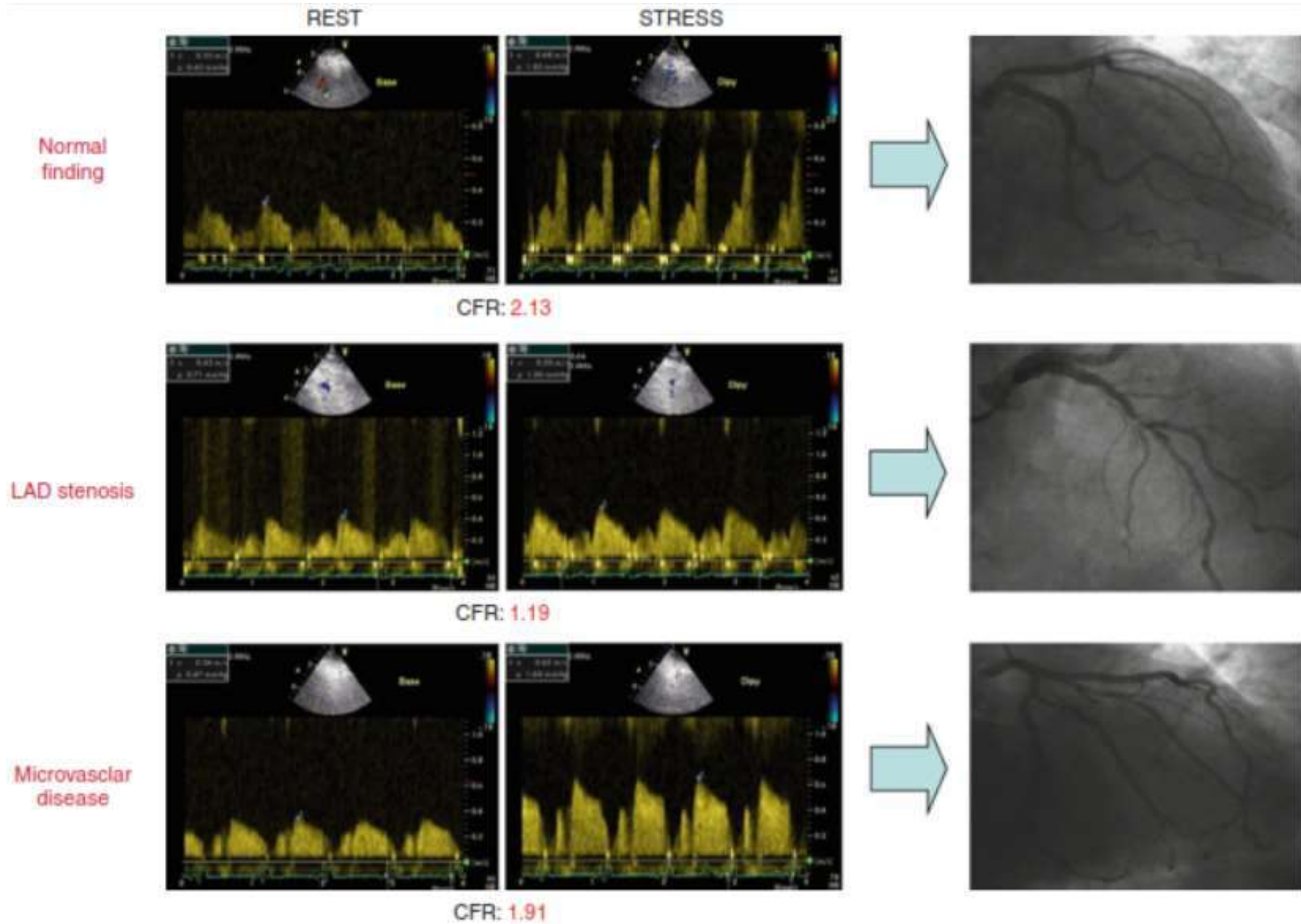
Sicari R, Cortigiani L, Bigi R, Landi P, Raciti M, Picano E. Circulation. 2004;109:1428–31.

Coronary Flow Reserve

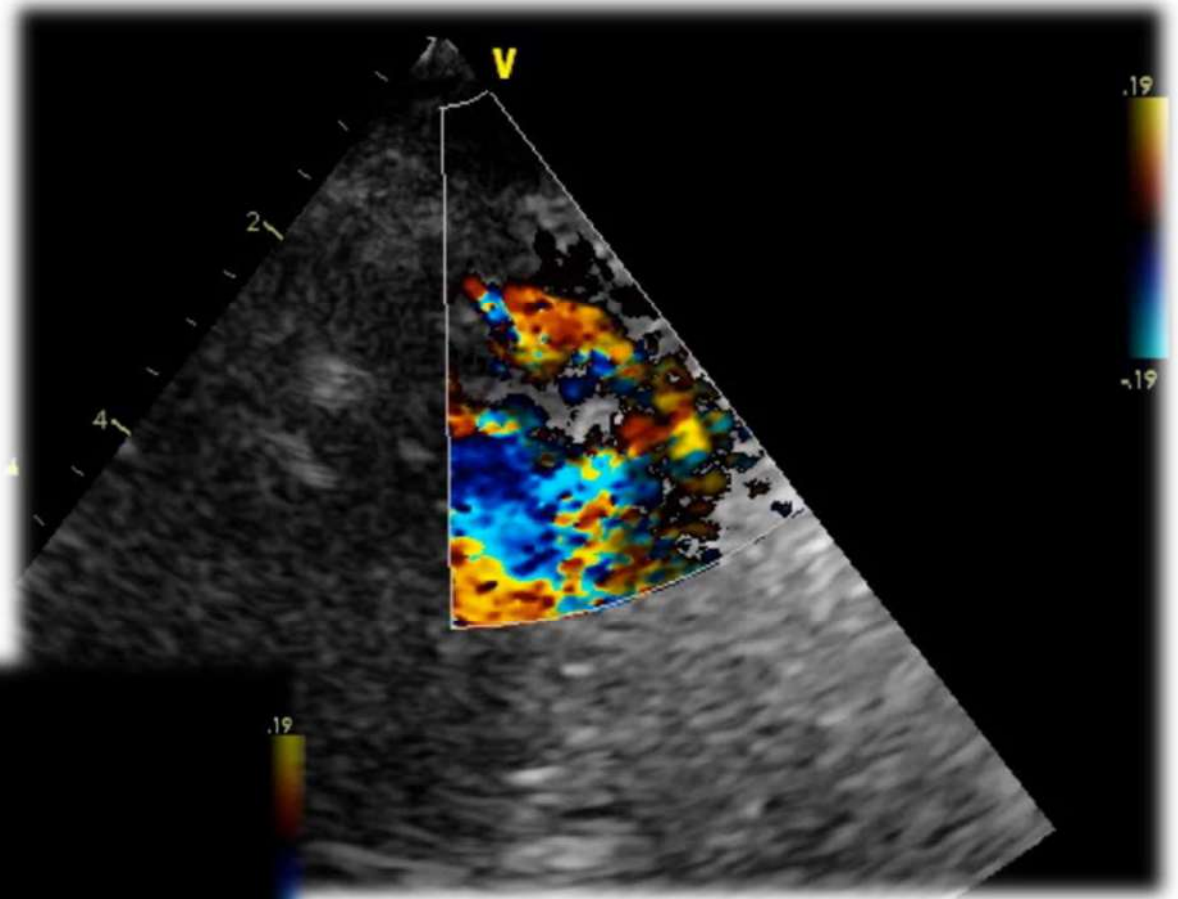
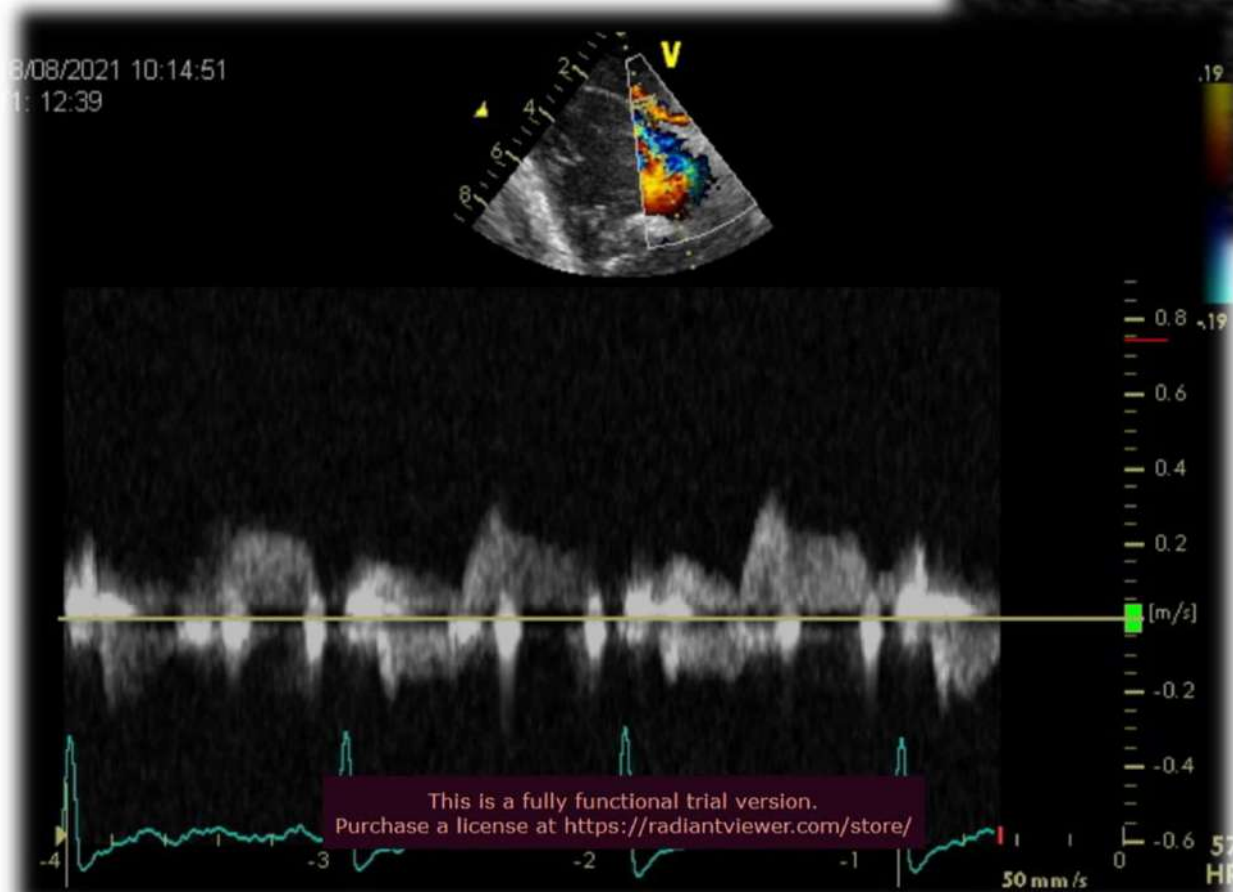
How to

- *Proiezione apicale 2 o 3 camere off axis; preset color Doppler flusso coronarico; Doppler pulsato con volume campione posizionato su IVA medio-distale (95% di fattibilità).*
- *Profilo flusso coronarico: picco basso in sistole e picco più alto in diastole.*
- *Valutazione variazione flusso coronarico tra registrazione basale e picco; CFR: Peak velocity/Rest velocity ($vn > 2$)*

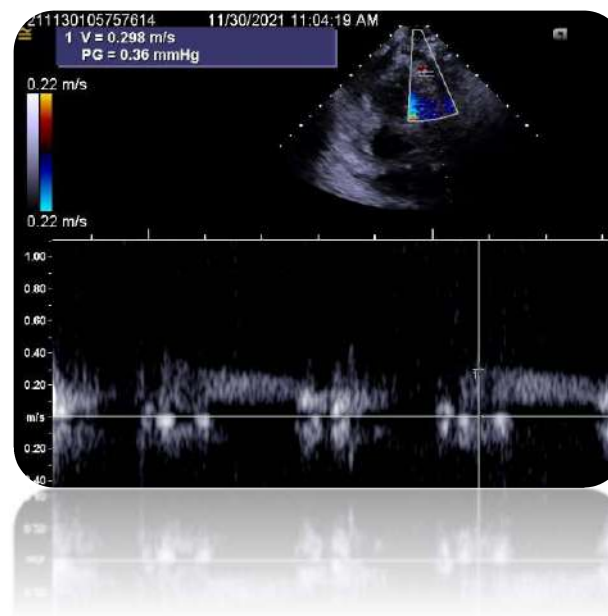
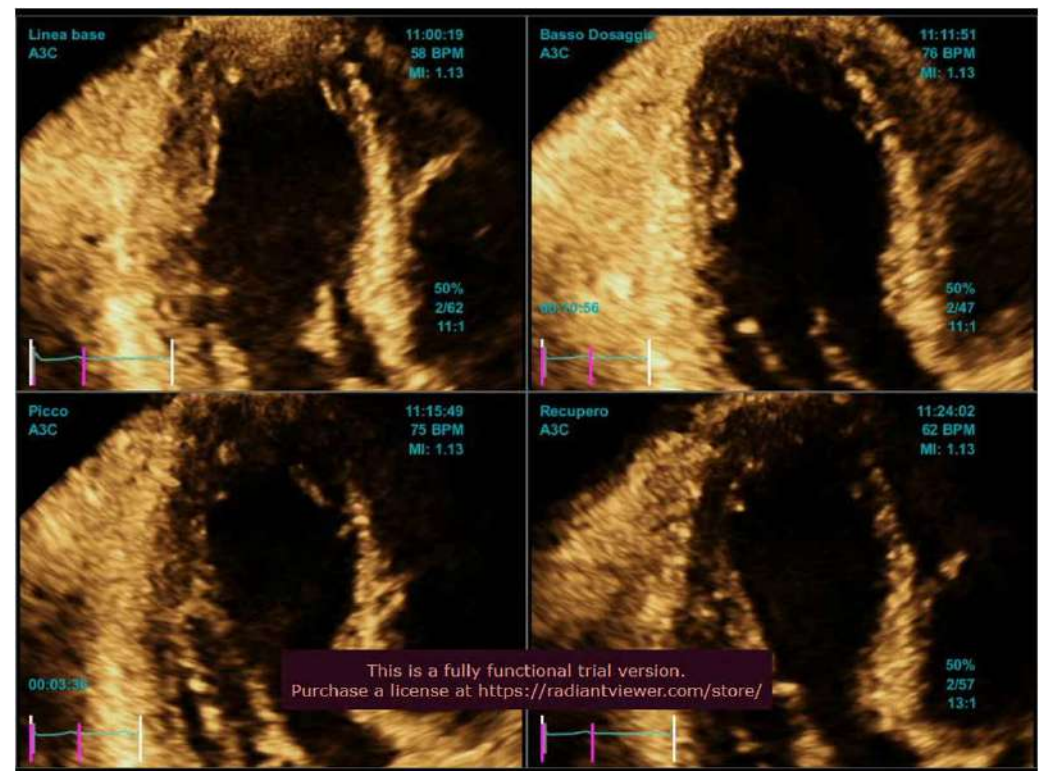
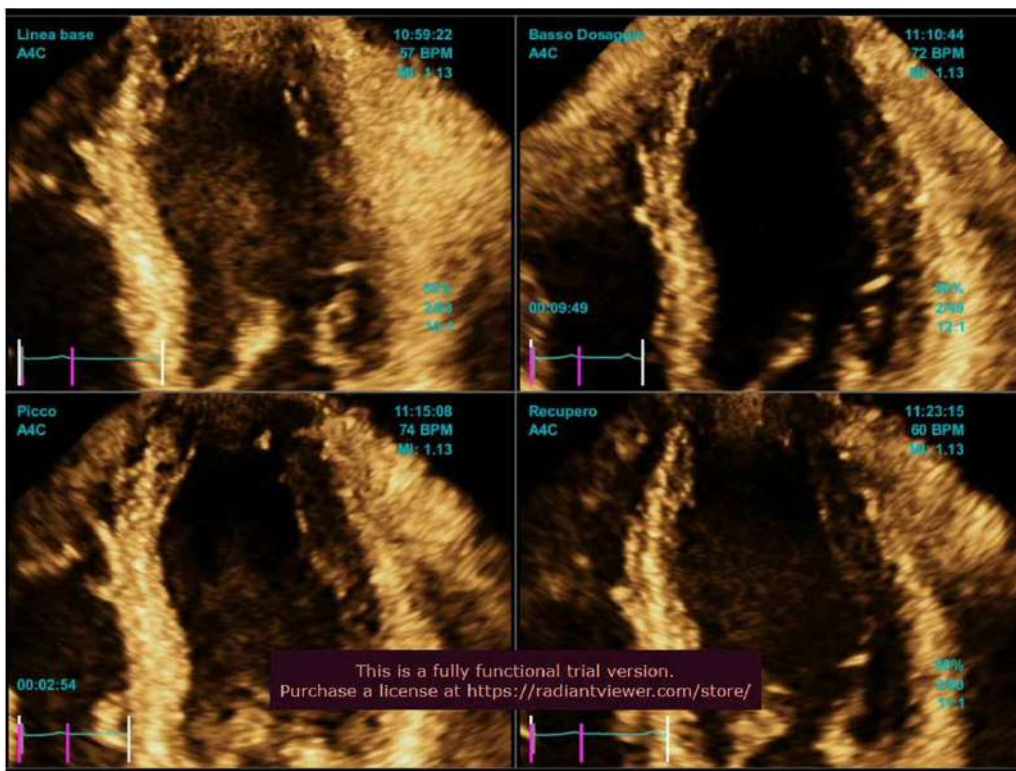




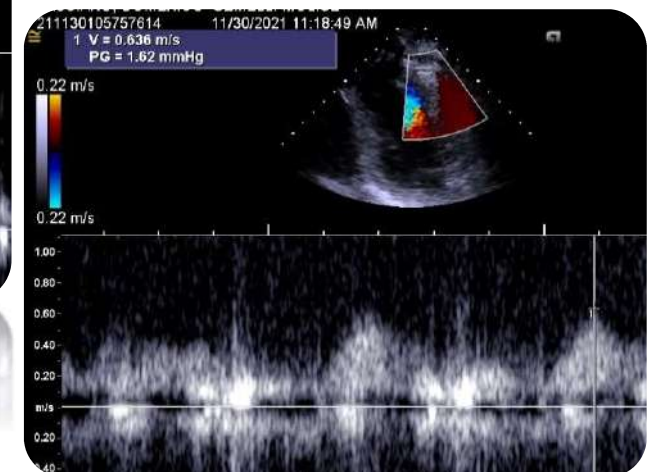
*Flusso nella discendente anteriore
visualizzato al PW Doppler*



*Flusso nella discendente anteriore
visualizzato al Color Doppler*



CFR 2,13



Dr. Antonio Totaro

Coronary Flow Reserve

Valore diagnostico

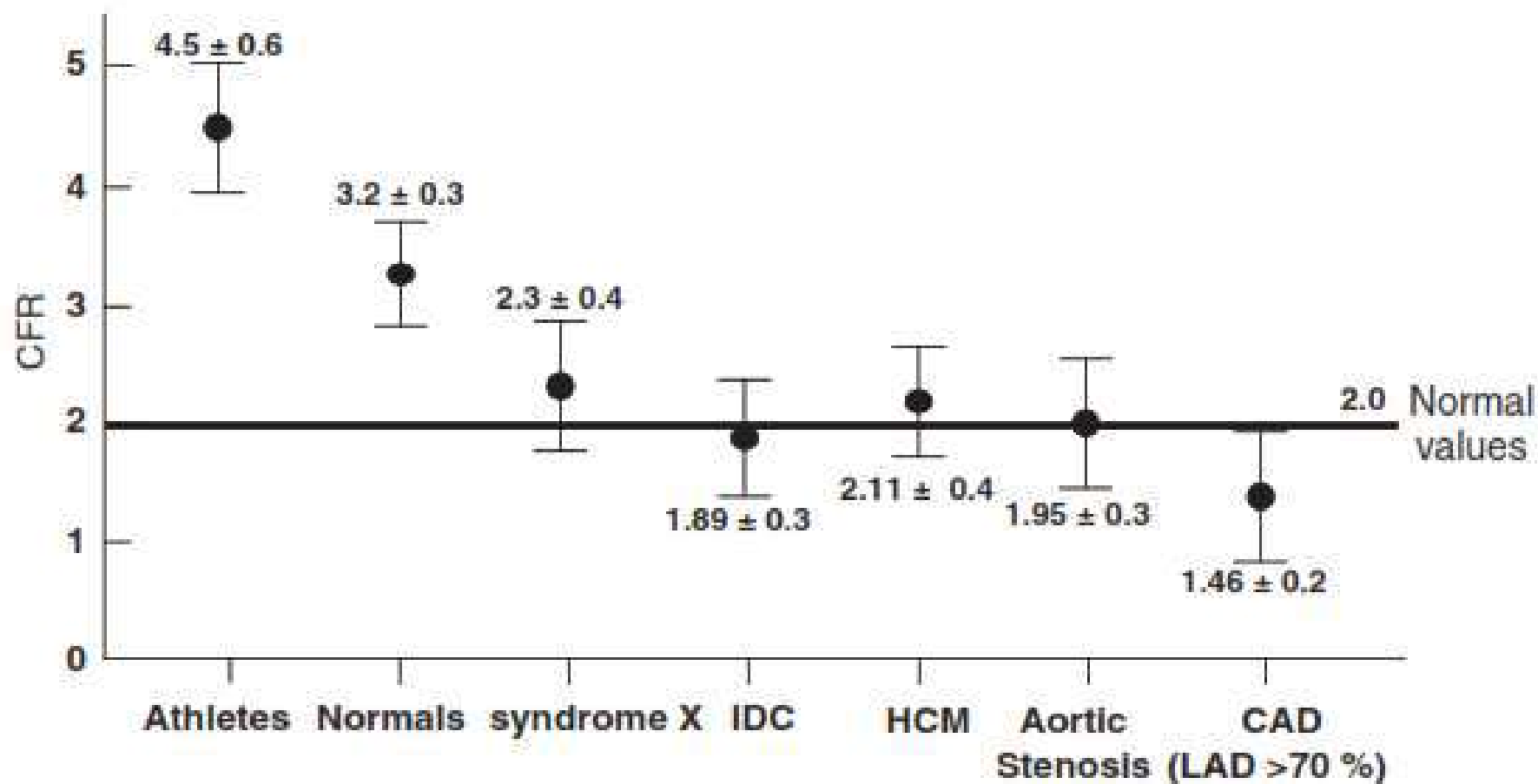
- *Limitazione: non distingue tra malattia coronarica macrovascolare e microvascolare*
- *La valutazione CRF insieme alla cinetica segmentaria aumenta la sensibilità del test*
- *La valutazione CFR è poco influenzata dalla terapia antischemica.*



Coronary Flow Reserve

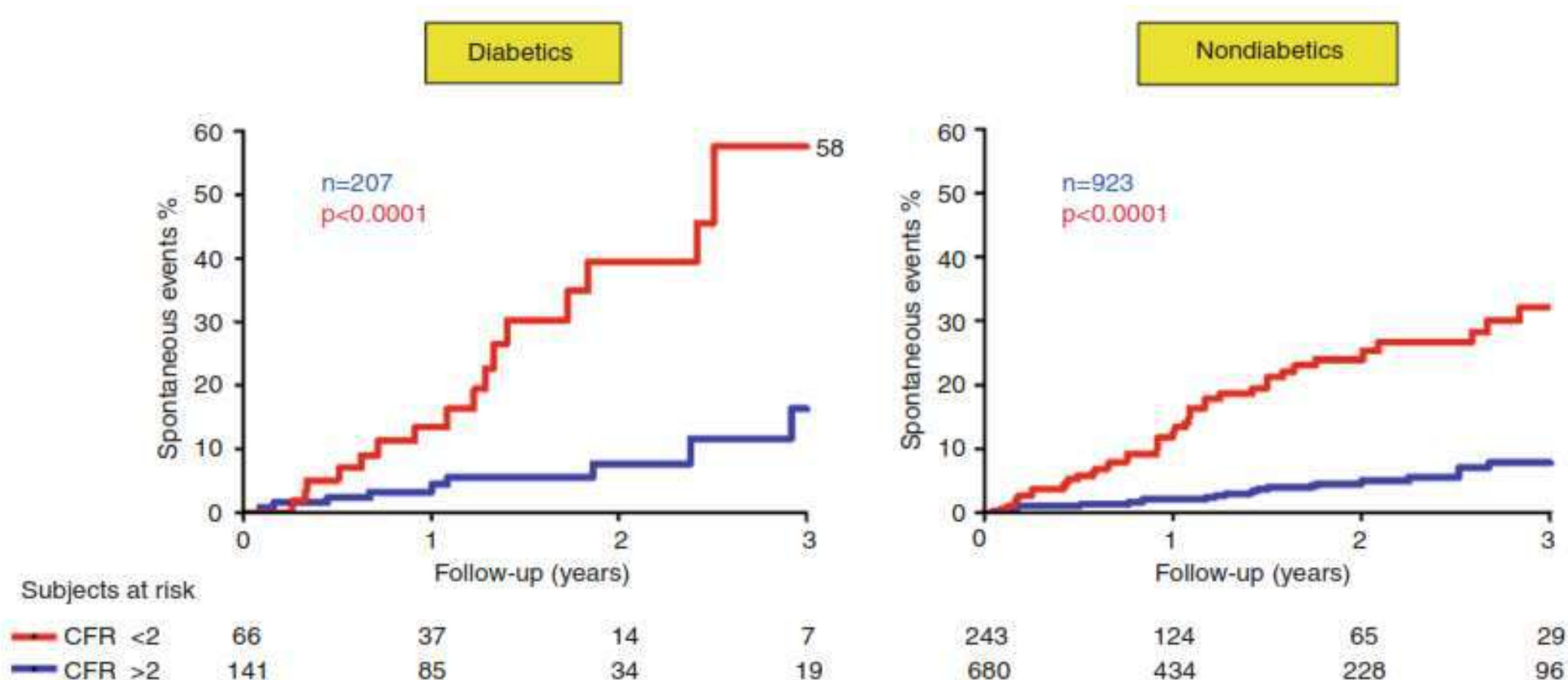
Valore diagnostico

Condizioni cliniche con coronarie epicariche normali e ridotta riserva di flusso in IVA



Coronary Flow Reserve Valore prognostico

Hard-event rate in pazienti diabetici e non diabetici con CFR normale o alterata e assenza di anomalie della cinetica segmentaria (malattia microvascolare).



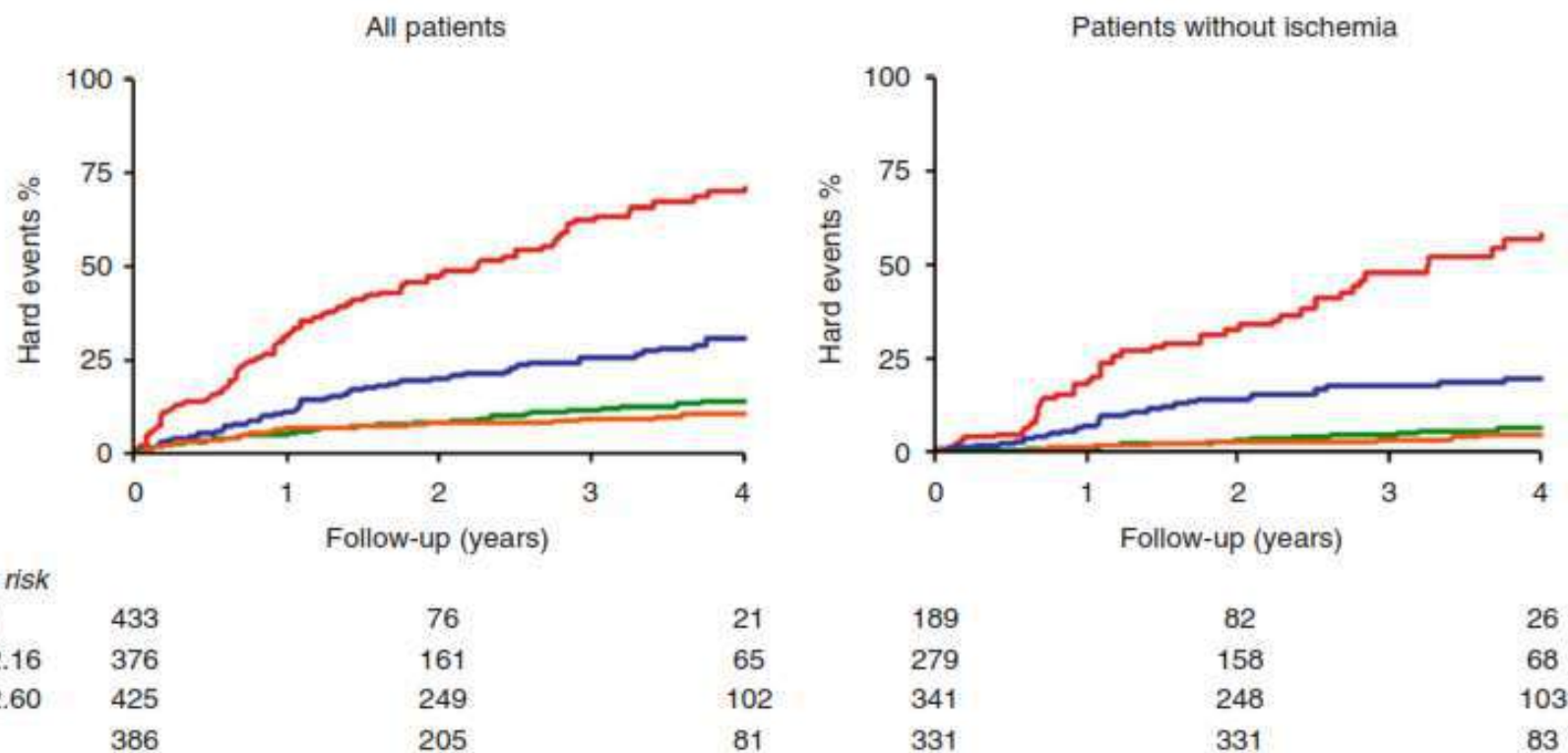
Cortigiani L, Rigo F, Gherardi S, Sicari R, Galderisi M, Bovenzi F, et al. J Am Coll Cardiol. 2007;50:1354–61



Coronary Flow Reserve

Valore prognostico

Hard-event rate per quartili di CFR nell'intera popolazione e nei pazienti senza anomalie della cinetica segmentaria (malattia microvascolare).

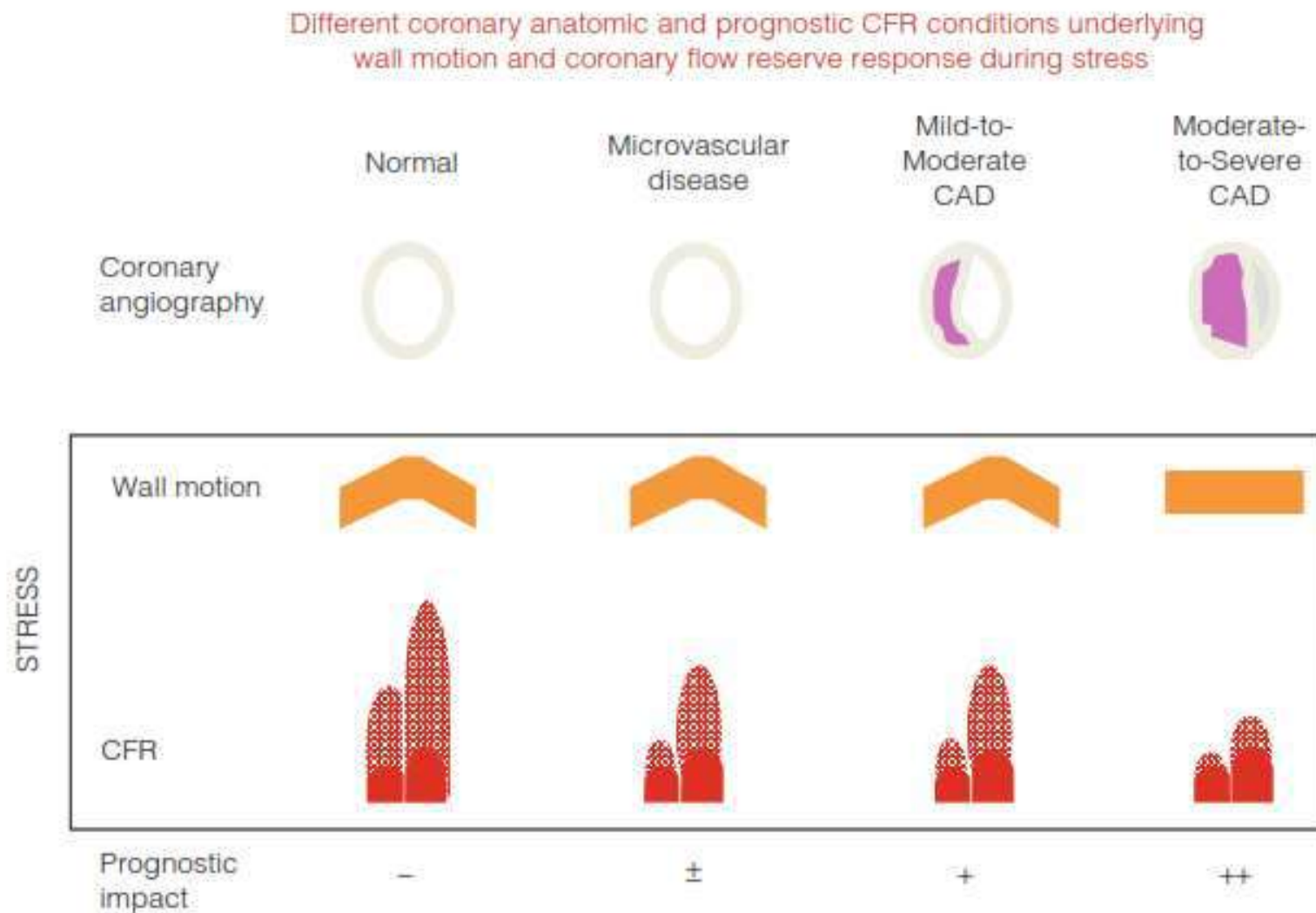


Cortigiani L, Rigo F, Gherardi S, Sicari R, Galderisi M, Bovenzi F, et al. J Am Coll Cardiol. 2007;50:1354–61



Coronary Flow Reserve

Valore prognostico



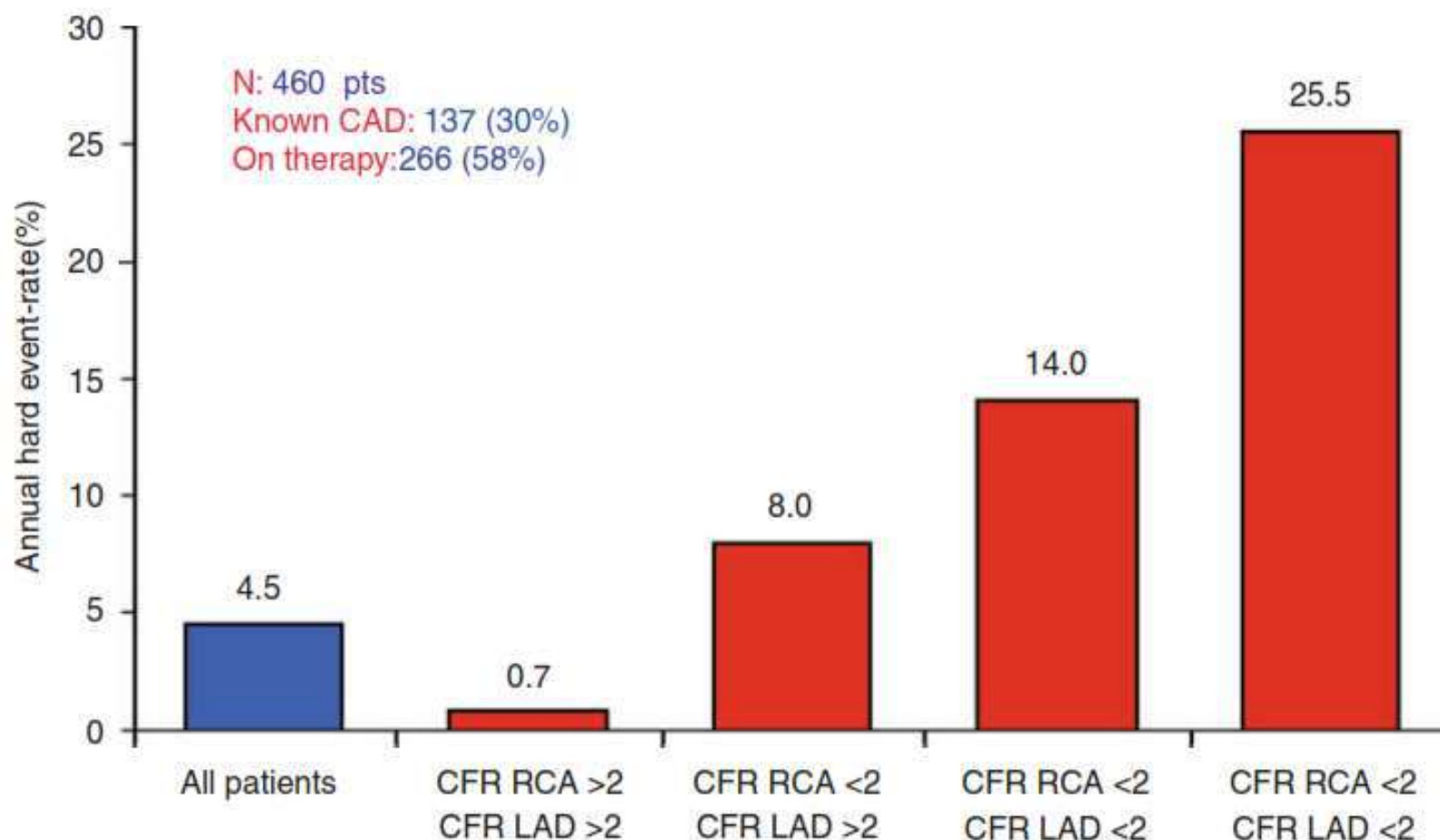
Rigo F, Sicari R, Gherardi S, Djordjevic-Dikic A, Cortigiani L, Picano E. Eur Heart J. 2008;29:79–88.



Coronary Flow Reserve

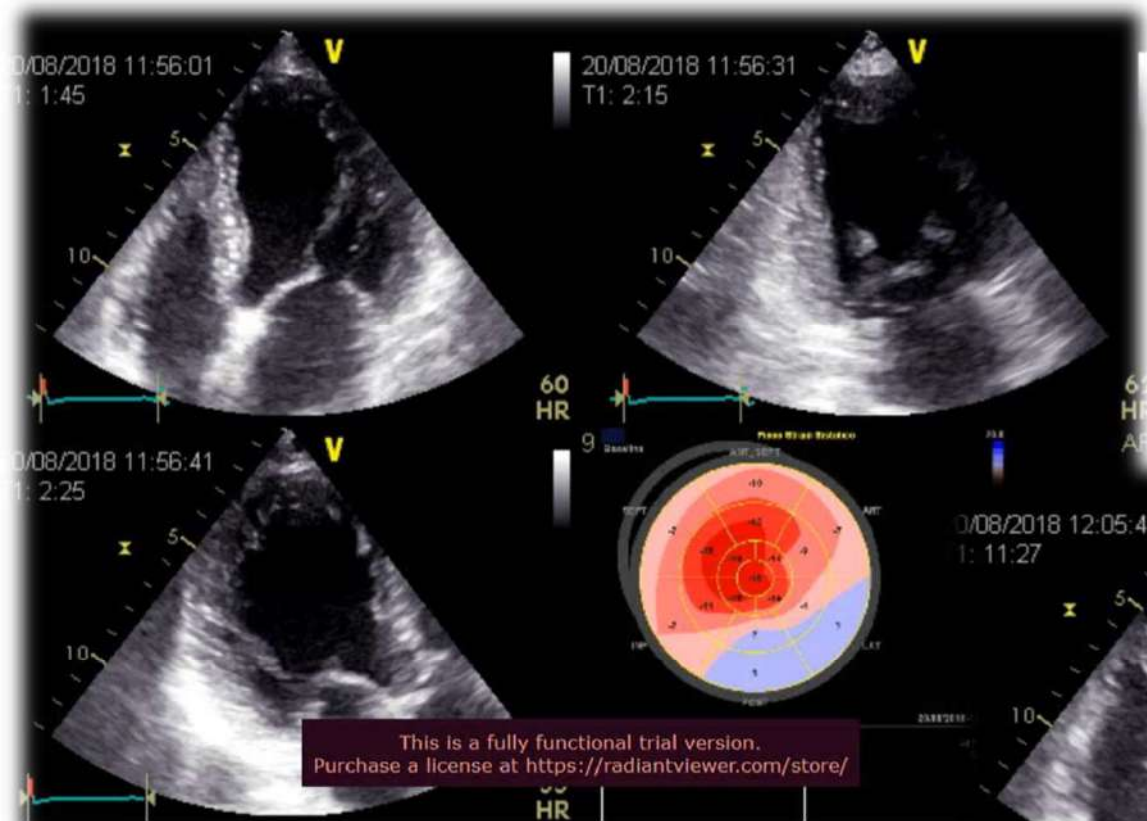
Valore prognostico

Annual event rate in pazienti con ecostress negativo per anomalie della cinetica segmentaria, divisi in differenti sottogruppi in base alla CRF

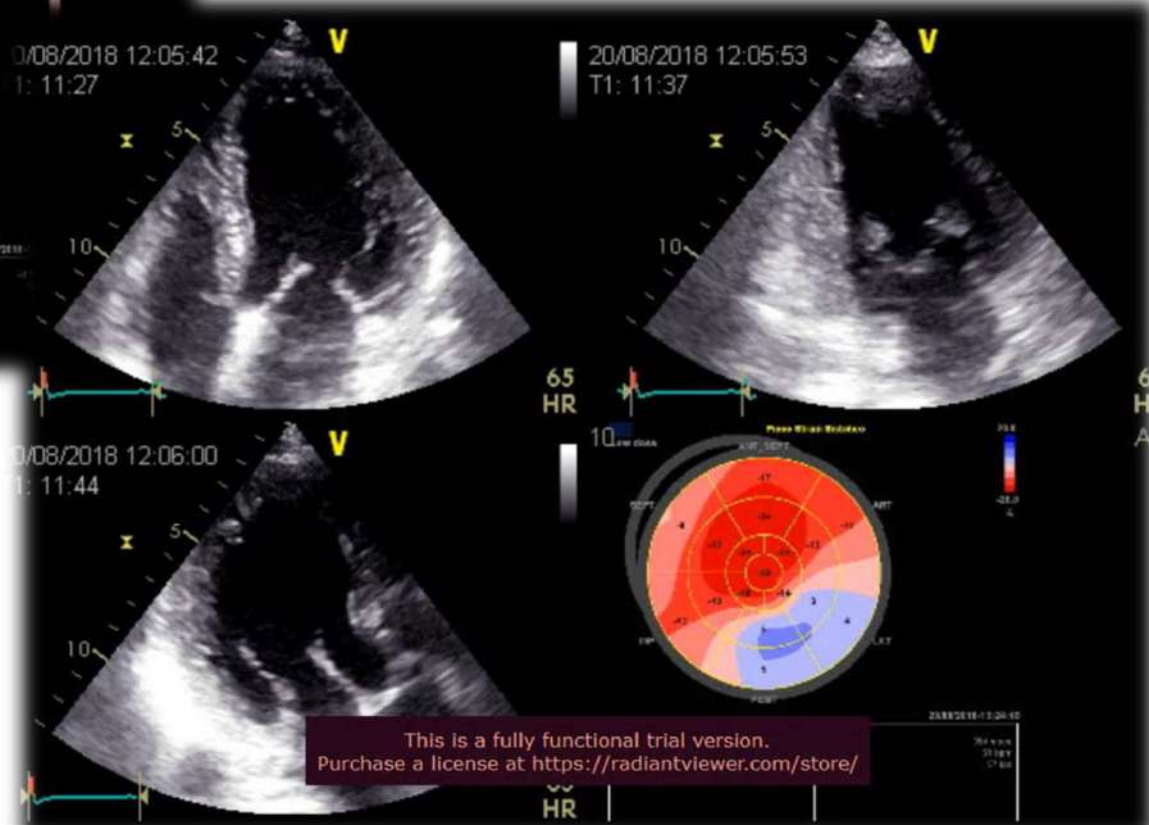


Bax JJ, Wijns W, Cornel JH, Visser FC, Boersma E, Fioretti PM.
J Am Coll Cardiol. 1997;30:1451–60.

Vitalità miocardica Ecotress dobutamina



Basso dosaggio di Dobutamina
10 gamma



Miocardio stordito, ibernato
o necrotico?



Vitalità miocardica *Ecostress dobutamina*

-Miocardio stordito: Sens 86% Spec 90% nel predire il recupero funzionale

-Miocardio ibernato: Sens 84% Spec 81% nel predire il recupero funzionale dopo rivascolarizzazione.

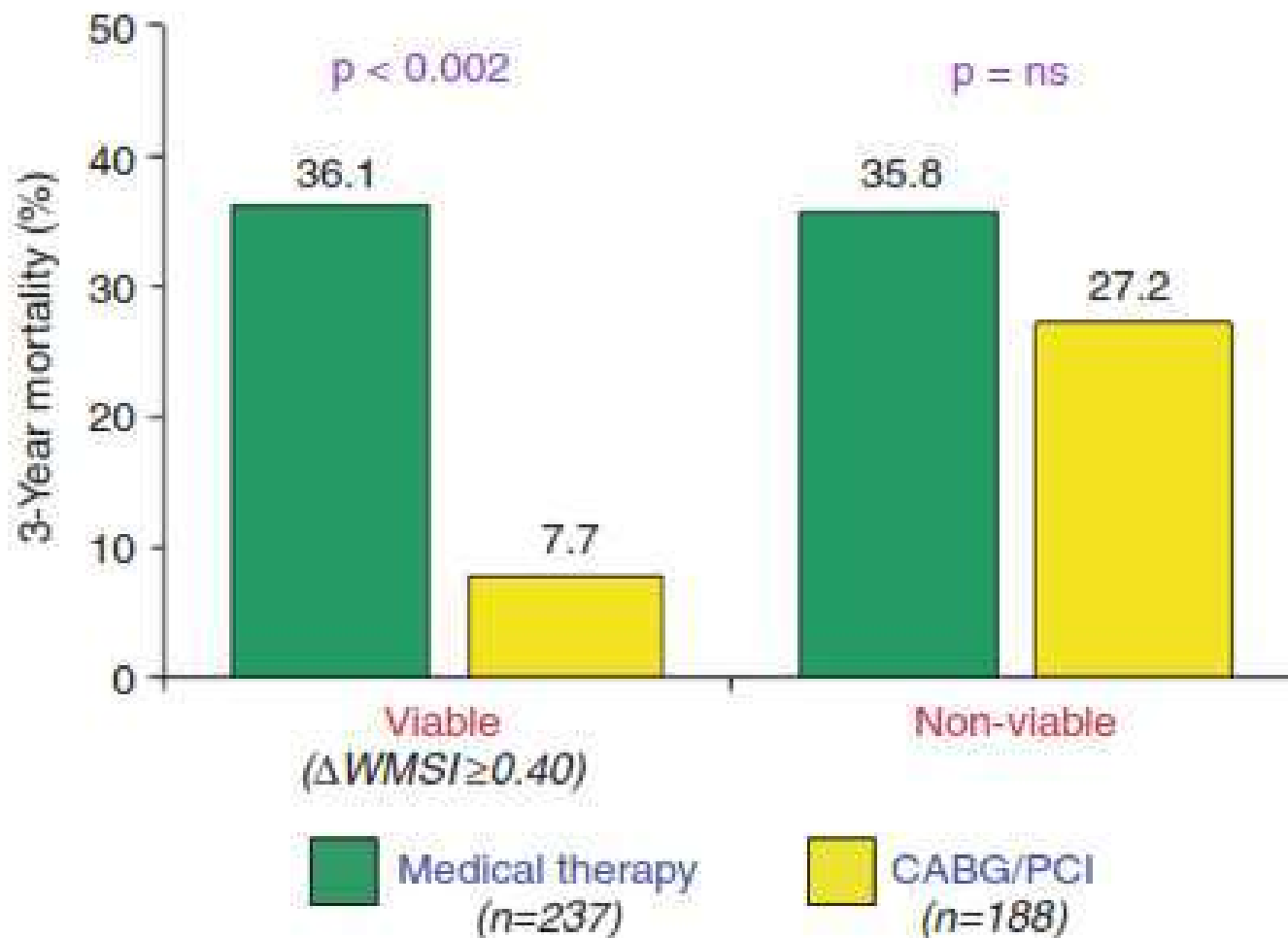
Confrontato con le metodiche nucleari, questo test presenta meno sensibilità ma più alta specificità.

La riserva contrattile evidenziata con ecostress Dob positivo richiede almeno il 50% dei miocardiociti vitali, rispetto alle metodiche nucleari che identificano segmenti con un numero inferiore di miociti vitali.



Vitalità miocardica Valore prognostico

*In pazienti con FE<35% e
sindrome coronarica
cronica, la presenza di
miocardio vitale (almeno
in 4 segmenti) è associata
con una ridotta mortalità
nei pazienti rivascolarizzati
rispetto a quelli trattati
conservativamente*



Sicari R et al. Am J Cardiol. 2003.

Il paziente diabetico

- ✓ *Forte associazione tra DM e cardiopatia ischemica.*
- ✓ *Maggiore incidenza di ischemia silente nei pz diabetici.*
- ✓ *ECG stress test nei pz diabetici ha una bassa sensibilità e discreta specificità.*
- ✓ *L'ecostress migliora la sensibilità e la specificità dell'ECG stress e aiuta a stratificare meglio il rischio dei pazienti diabetici.*



Patients with type 2 diabetes mellitus

Patients with type 1 DM above 40 years of age may also be classified according to these criteria

Patients with well controlled short-standing DM (e.g. <10 years), no evidence of TOD and no additional ASCVD risk factors

Moderate-risk

N/A

Patients with DM without ASCVD and/or severe TOD, and not fulfilling the moderate risk criteria.

High-risk

Residual 10-year CVD risk estimation after general prevention goals (e.g. with the ADVANCE risk score or DIAL model). Consider lifetime CVD risk and benefit estimation of risk factor treatment (e.g. DIAL model).

Patients with DM with established ASCVD and/or severe TOD:^{87, 93-95}

- eGFR <45 mL/min/1.73 m² irrespective of albuminuria
- eGFR 45-59 mL/min/1.73 m² and microalbuminuria (ACR 30 -300 mg/g)
- Proteinuria (ACR >300 mg/g)
- Presence of microvascular disease in at least 3 different sites (e.g. microalbuminuria plus retinopathy plus neuropathy)

Very high-risk

Residual 10-year CVD risk estimation after general prevention goals (e.g. with the SMART risk score for established CVD or with the ADVANCE risk score or with the DIAL model). Consider lifetime CVD risk and benefit estimation of risk factor treatment (e.g. DIAL model).

presence of microvascular disease in at least 3 different sites (e.g. microalbuminuria plus retinopathy plus neuropathy)

Moderate-risk

Residual 10-year CVD risk estimation after general prevention goals (e.g. with the ADVANCE risk score or with the DIAL model). Consider lifetime CVD risk and benefit estimation of risk factor treatment (e.g. DIAL model).

Dr. Antonio Totaro



Use of diagnostic imaging tests in the initial diagnostic management of symptomatic patients with suspected coronary artery disease

Recommendations	Class ^a	Level ^b
Non-invasive functional imaging for myocardial ischaemia ^c or coronary CTA is recommended as the initial test to diagnose CAD in symptomatic patients in whom obstructive CAD cannot be excluded by clinical assessment alone. ^{4,5,55,73,78–80}	I	B
It is recommended that selection of the initial non-invasive diagnostic test is done based on the clinical likelihood of CAD and other patient characteristics that influence test performance, ^d local expertise, and the availability of tests.	I	C
Functional imaging for myocardial ischaemia is recommended if coronary CTA has shown CAD of uncertain functional significance or is not diagnostic. ^{4,55,73}	I	B
Invasive coronary angiography is recommended as an alternative test to diagnose CAD in patients with a high clinical likelihood, severe symptoms refractory to medical therapy or typical angina at a low level of exercise, and clinical evaluation that indicates high event risk. Invasive functional assessment must be available and used to evaluate stenoses before revascularization, unless very high grade (>90% diameter stenosis). ^{71,72,74}	I	B
Invasive coronary angiography with the availability of invasive functional evaluation should be considered for confirmation of the diagnosis of CAD in patients with an uncertain diagnosis on non-invasive testing. ^{71,72}	IIa	B
Coronary CTA should be considered as an alternative to invasive angiography if another non-invasive test is equivocal or non-diagnostic.	IIa	C
Coronary CTA is not recommended when extensive coronary calcification, irregular heart rate, significant obesity, inability to cooperate with breath-hold commands, or any other conditions make obtaining good image quality unlikely.	III	C
Coronary calcium detection by CT is not recommended to identify individuals with obstructive CAD.	III	C

© ESC 2019

CAD = coronary artery disease; CT = computed tomography; CTA = computed tomography angiography.

^aClass of recommendation.

^bLevel of evidence

^cStress echocardiography, stress cardiac magnetic resonance, single-photon emission CT, or positron emission tomography.

^dCharacteristics determining ability to exercise, likelihood of good image quality, expected radiation exposure, and risks or contraindications.



Table 5 Pre-test probabilities of obstructive coronary artery disease in 15 815 symptomatic patients according to age, sex, and the nature of symptoms in a pooled analysis⁶⁴ of contemporary data^{7,8,62}

	Typical		Atypical		Non-anginal		Dyspnoea ^a	
Age	Men	Women	Men	Women	Men	Women	Men	Women
30–39	3%	5%	4%	3%	1%	1%	0%	3%
40–49	22%	10%	10%	6%	3%	2%	12%	3%
50–59	32%	13%	17%	6%	11%	3%	20%	9%
60–69	44%	16%	26%	11%	22%	6%	27%	14%
70+	52%	27%	34%	19%	24%	10%	32%	12%

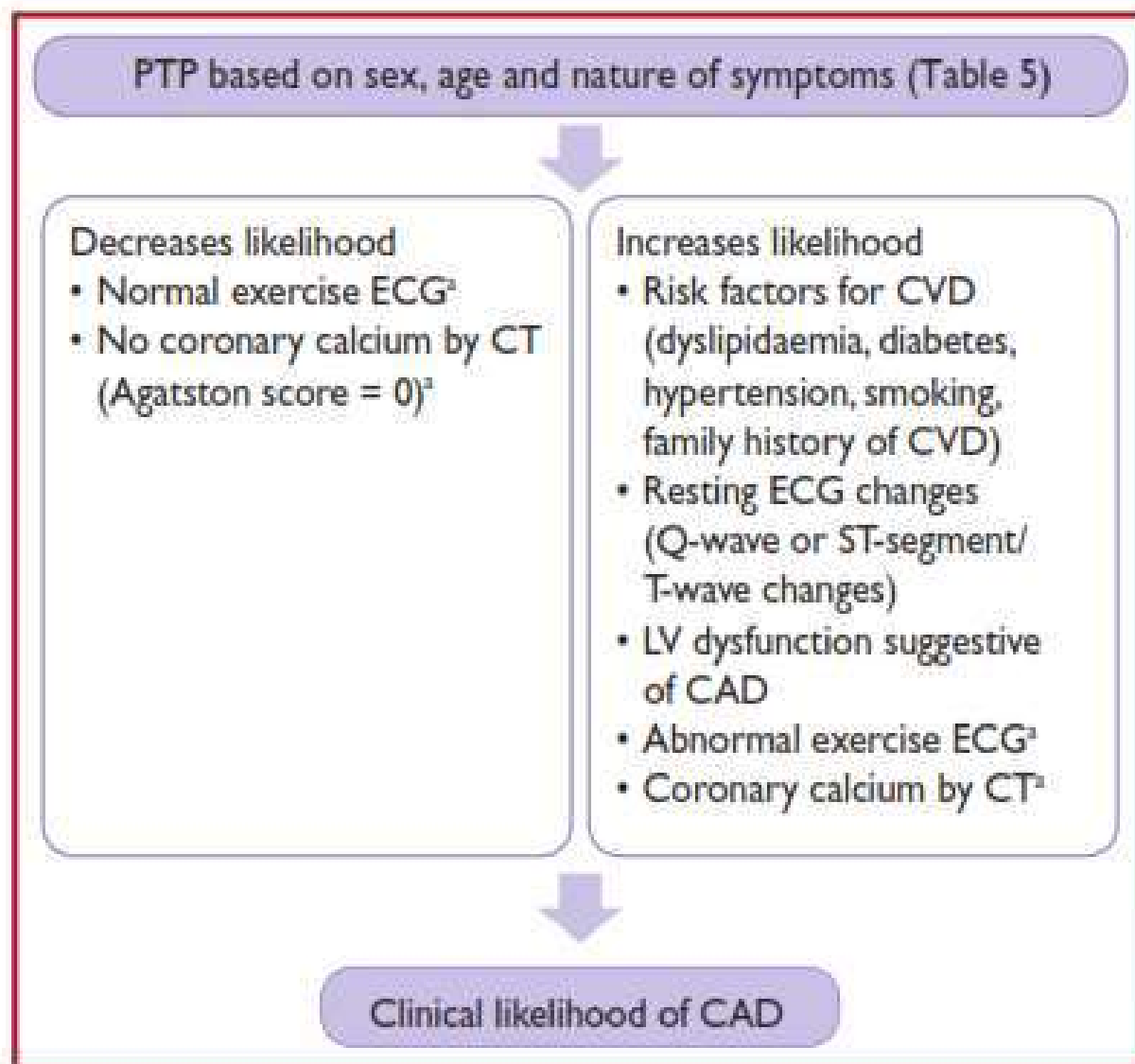
©ESC 2019

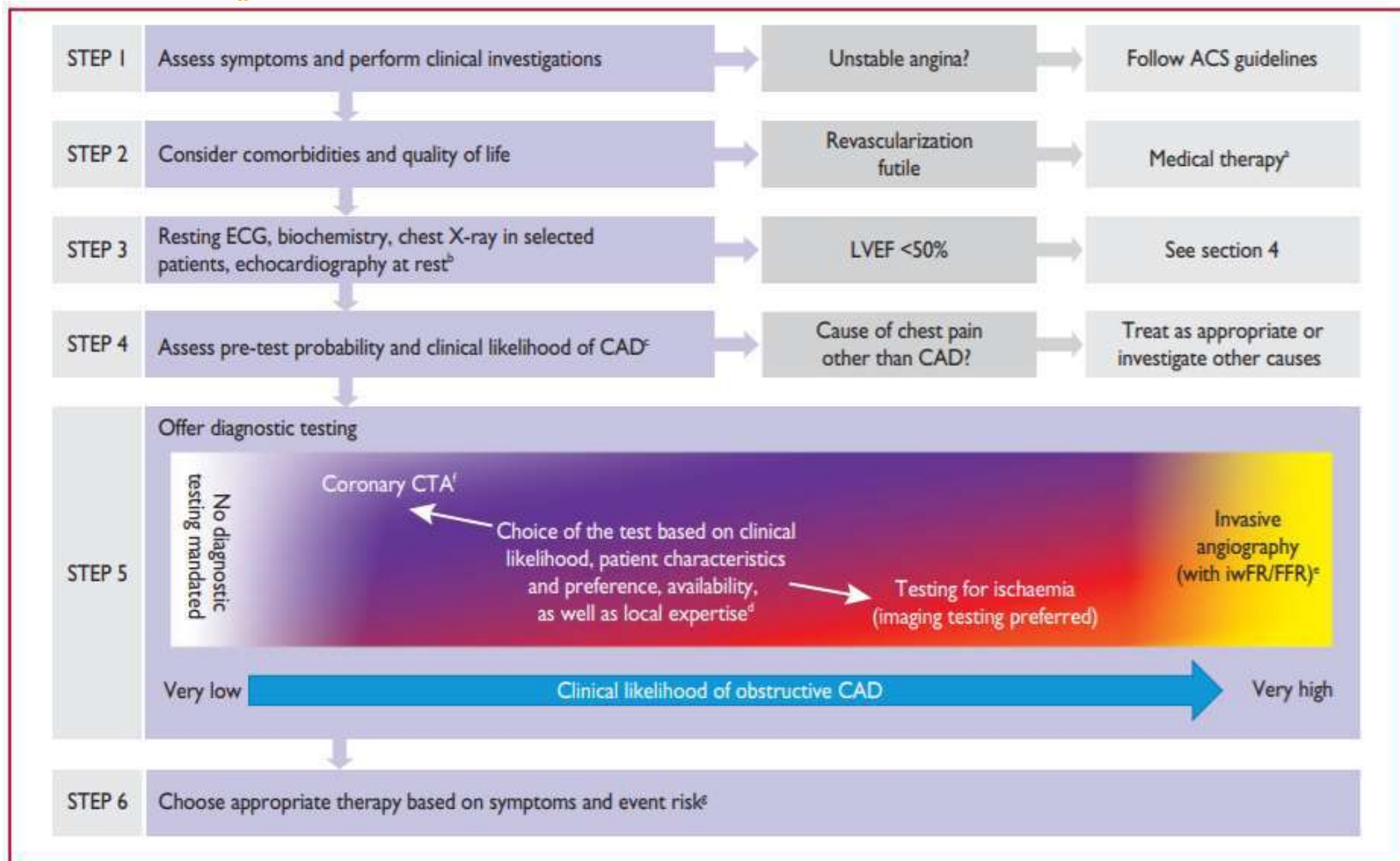
CAD = coronary artery disease; PTP = pre-test probability.

^aIn addition to the classic Diamond and Forrester classes,⁵⁹ patients with dyspnoea only or dyspnoea as the primary symptom are included. The regions shaded dark green denote the groups in which non-invasive testing is most beneficial (PTP >15%). The regions shaded light green denote the groups with PTPs of CAD between 5–15%, in which testing for diagnosis may be considered after assessing the overall clinical likelihood based on the modifiers of PTPs presented in Figure 3.

Testing for diagnosis may be considered after assessing the overall clinical likelihood based on the modifiers of PTPs presented in Figure 3. The regions shaded dark green denote the groups in which non-invasive testing is most beneficial (PTP >15%). The regions shaded light green denote the groups with PTPs of CAD between 5–15%, in which testing for diagnosis may be considered after assessing the overall clinical likelihood based on the modifiers of PTPs presented in Figure 3. CAD = coronary artery disease; PTP = pre-test probability.







Studio anatomico alternativo al funzionale

- ✓ *Registro CONFIRM ha dimostrato che la severità della CAD è superiore ai fattori di rischio clinici e i sintomi nel predire il rischio.*
- ✓ *SCOT-HEART trial ha dimostrato che i pz sottoposti a CT aveva una riduzione del 40% del rischio di morte per CAD o IM non fatale, legato al maggiore uso di statina e asa nel gruppo CT.*
- ✓ *PROMISE trial: nessuna differenza nell'outcome dei pz sottoposti a test funzionale o anatomico*
- ✓ *Maggiore incidenza di ischemia silente nei pz diabetici.*
- ✓ *ECG stress test nei pz diabetici ha una bassa sensibilità e discreta specificità.*



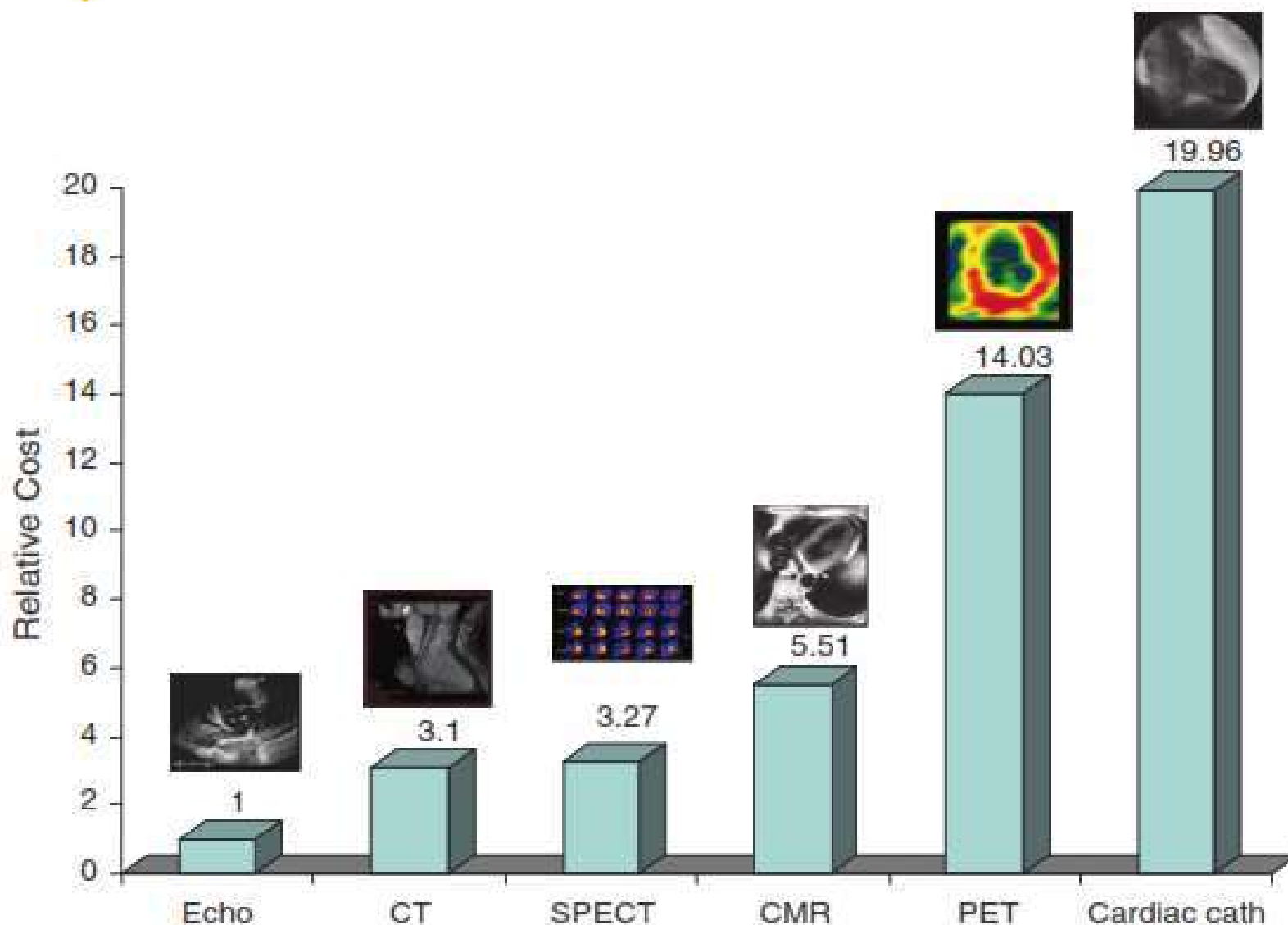
RCA_2



This is a fully functional tri



Imaging Cardiac e Costi



European Commission.
Radiation protection 118: referral guidelines for imaging.

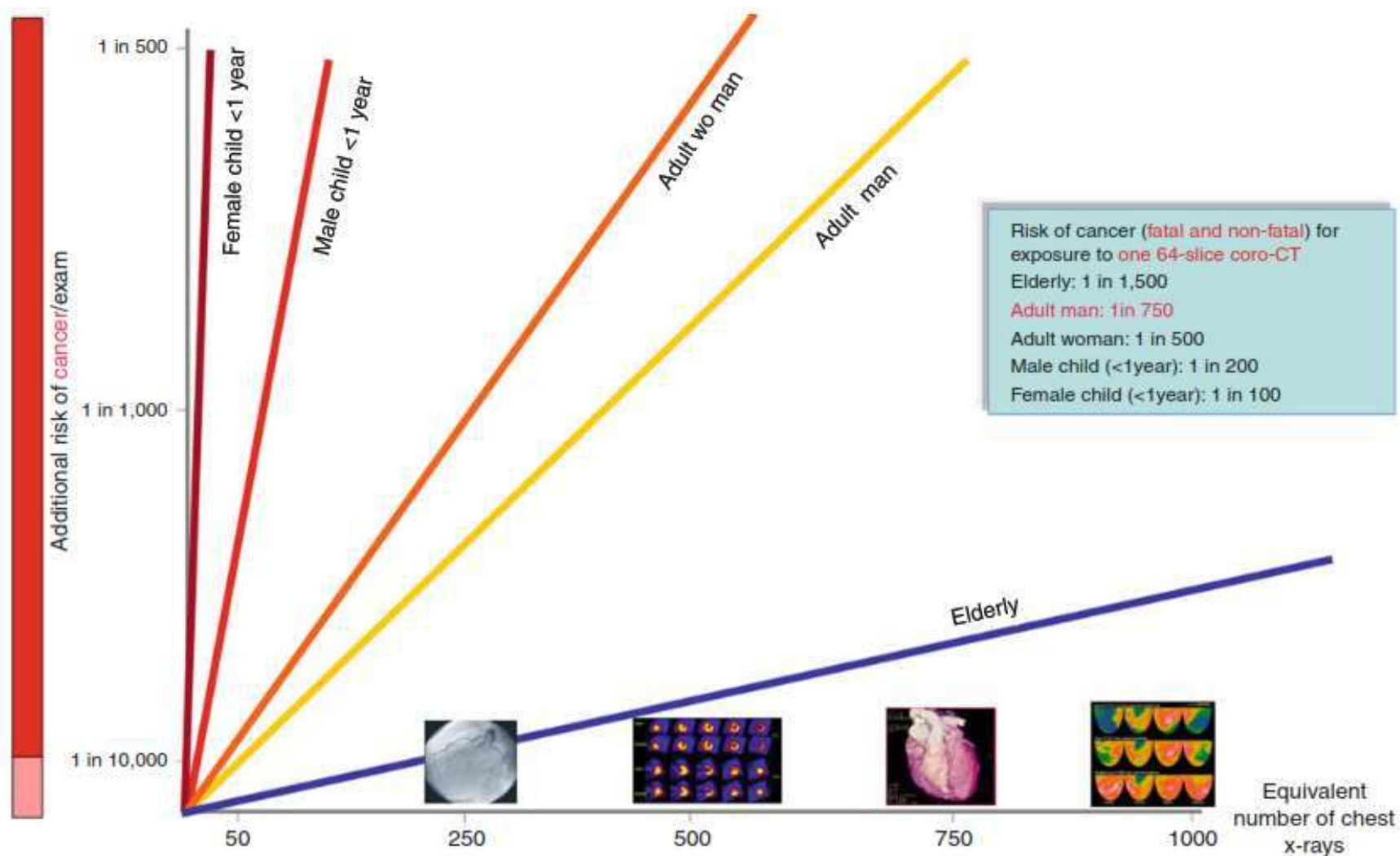


- ✓ *Small individual risks multiplied by billions of examinations become significant population risks*
- ✓ *At least 10% of all cancers are due to diagnostic imaging, and at least half of them come from cardiac examination*
- ✓ *The dose of a single nuclear cardiology procedure range from 27 mSv (>1,500 chest X-rays) from a thallium scan to 10 mSv (500 chest X-rays) from a technetium-MIBI scan.*
- ✓ *One millisievert corresponds to the dose equivalent of 50 chest X-rays*
- ✓ *According to the latest estimation of BEIR VII (2006), this exposure dose corresponds to an extra-lifetime risk of cancer per examination ranging from 1 in 500 (thallium) to 1 in 1,000 (sestamibi)*
- ✓ *The estimated 10 million cardiac CT studies per year yield an additional 15,000 new cancers per year in the USA alone*



Examination	Effective dose (mSv)	Equivalent no. of chest X-rays
<i>Conventional radiology</i>		
■ Chest X-ray (single postero-anterior)	0.02	1
<i>Nuclear medicine</i>		
■ Tc-99m tetrafosmin cardiac rest-stress (10 mCi + 30 mCi) ^a	10.6	530
■ Tc-99m sestamibi cardiac 1-day rest-stress (10 mCi + 30 mCi) ^a	12	600
■ Tc-99m sestamibi cardiac 2-day stress-rest (30 mCi + 30 mCi) ^a	17.5	775
■ Tl-201 cardiac stress and reinjection (3.0 mCi + 1.0 mCi) ^a	25	1,250
■ Dual isotope cardiac (3.0 mCi Tl201 + 30 mCi Tc-99m) ^a	27	1,350
<i>64-Slice Cardiac computed tomography</i>		
■ ECG pulsing, no aorta ^b	9	450
■ No ECG pulsing, yes aorta ^b	29	1,450
<i>Interventional radiology</i>		
■ Conventional rhythm device ^c	1.4	70
■ Cardiac resynchronization device ^c	5.5	275
■ Cerebral angiography ^c	1.6–10.6	80–530
■ Coronary angiography ^c	3.1–10.6	155–555
■ Abdominal angiography ^c	6–23	300–1,150
■ Peripheral angiography ^c	2.7–14	135–700
■ Coronary angioplasty ^c	6.8–28.9	340–1,445
■ Peripheral angioplasty ^c	10–12	500–600
■ Radiofrequency ablation ^c	17–25	850–1,250
■ Valvuloplasty ^c	29	1,450





Decreto Legislativo 26 maggio 2000, n. 187

Attuazione della direttiva 97/43/ EURATOM in materia di protezione sanitaria delle persone contro i pericoli delle radiazioni ionizzanti connesse ad esposizioni mediche.

Modificato dall'art. 39, Legge 1 marzo 2002, n. 39

Articolo 3

Principio di giustificazione

1. E' vietata l'esposizione non giustificata.
2. Le esposizioni mediche di cui all'articolo 1, comma 2, devono mostrare di essere sufficientemente efficaci mediante la valutazione dei potenziali vantaggi diagnostici o terapeutici complessivi da esse prodotti, inclusi i benefici diretti per la salute della persona e della collettività, rispetto al danno alla persona che l'esposizione potrebbe causare, tenendo conto dell'efficacia, dei vantaggi e dei rischi di tecniche alternative disponibili, che si propongono lo stesso obiettivo, ma che non comportano un'esposizione, ovvero comportano una minore esposizione alle radiazioni ionizzanti. In particolare:

Articolo 14

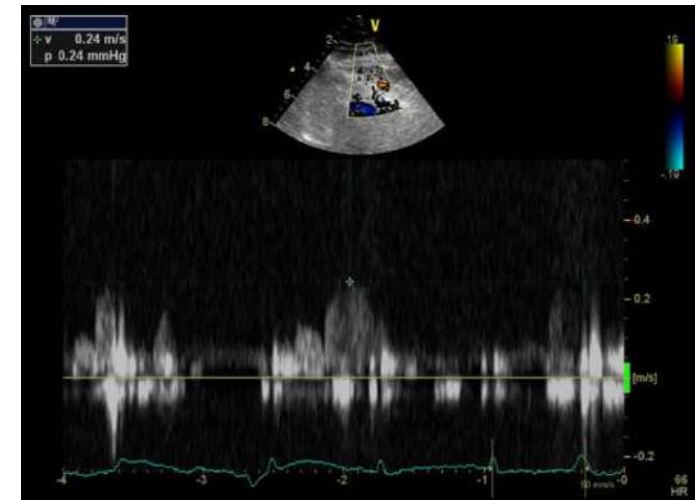
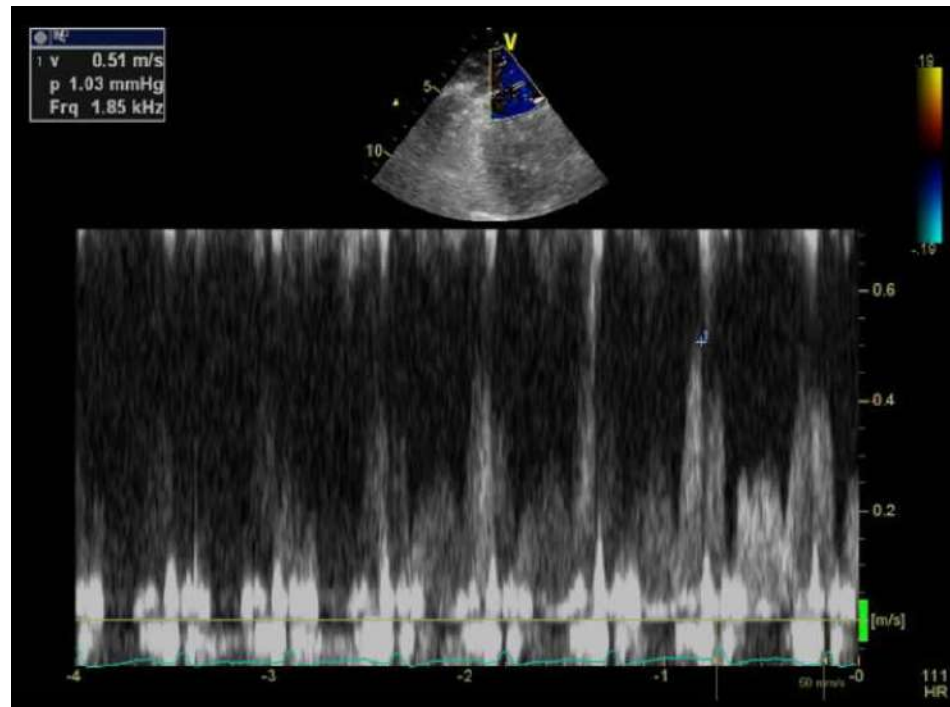
Apparato sanzionatorio

1. La violazione degli obblighi di cui all'articolo 3, in tema di giustificazione, ed all'articolo 4, in tema di ottimizzazione, è punita con l'arresto sino a tre mesi o con l'ammenda da lire cinque milioni a lire venti milioni.



Grazie per l'attenzione





Recommendations for diabetes mellitus in chronic coronary syndromes

Recommendations	Class ^a	Level ^b
Risk factor (BP, LDL-C, and HbA1c) control to targets is recommended in patients with CAD and diabetes mellitus. ^{482–484}	I	A
In asymptomatic patients with diabetes mellitus, a periodic resting ECG is recommended for cardiovascular detection of conduction abnormalities, AF, and silent MI.	I	C
ACE inhibitor treatment is recommended in CCS patients with diabetes for event prevention. ⁴⁸²	I	B
The sodium-glucose co-transporter 2 inhibitors empagliflozin, canagliflozin, or dapagliflozin are recommended in patients with diabetes and CVD. ^{c 485–487}	I	A
A glucagon-like peptide-1 receptor agonist (liraglutide or semaglutide) is recommended in patients with diabetes and CVD. ^{c 488–490}	I	A
In asymptomatic adults (age >40 years) with diabetes, functional imaging or coronary CTA may be considered for advanced cardiovascular risk assessment. ^{491,492}	IIb	B

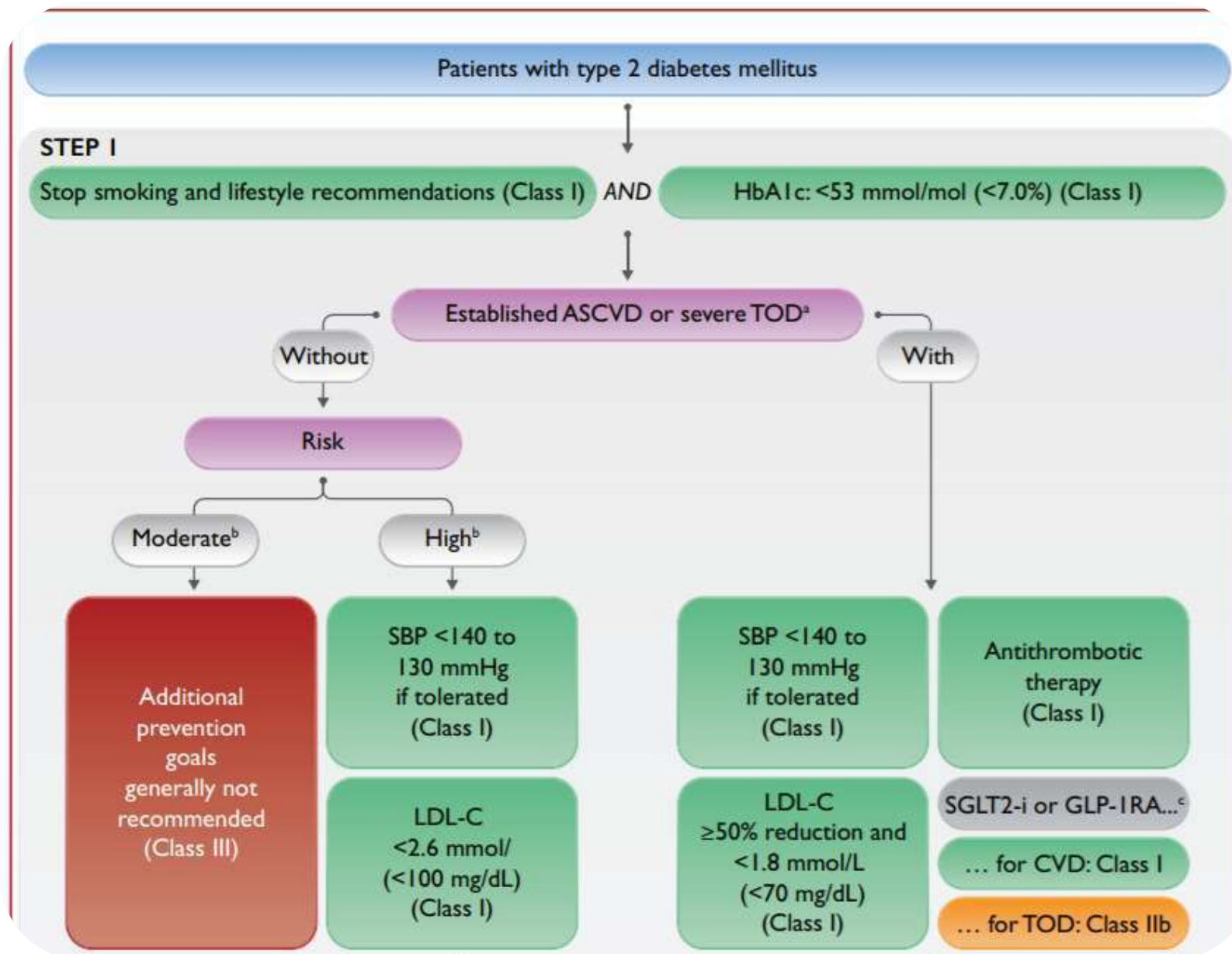
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arrhythmias. The high prevalence of significant CAD and prohibitively high cardiovascular mortality may suggest the usefulness of routine screening for CAD (with functional imaging testing or coronary CTA) in asymptomatic patients with diabetes, but no data have shown an improvement in outcomes so far. Routine use of CTA in asymptomatic patients with diabetes is therefore not recommended.





Accuratezza diagnostica

- **Sensibilità:** capacità di identificare correttamente i soggetti ammalati. Se un test ha un'ottima sensibilità, allora è **basso il rischio di falsi negativi**.

ALTA SENSIBILITÀ = alta probabilità che un soggetto malato risulti positivo al test; = bassa probabilità che un soggetto malato risulti negativo al test.

- **Specificità:** capacità di identificare correttamente i soggetti sani. Se un test ha un'ottima specificità, allora è **basso il rischio di falsi positivi**.

ALTA SPECIFICITÀ = alta probabilità che un soggetto sano risulti negativo al test; = bassa probabilità che un soggetto sano risulti positivo al test

