Ά Καρδιολογική Κλινική ΑΧΕΠΑ

Η Αξονική Στεφανιογραφία πρέπει να είναι το εργαλείο απεικόνισης πρώτης γραμμής για τη διάγνωση της στεφανιαίας νόσου

ΥΠΕΡ

Βασίλειος Καμπερίδης MD, MSc, PhD, FESC, FEACVI

Επίκουρος Καθηγητής Καρδιολογίας & Καρδιαγγειακής Απεικόνισης ΑΠΘ

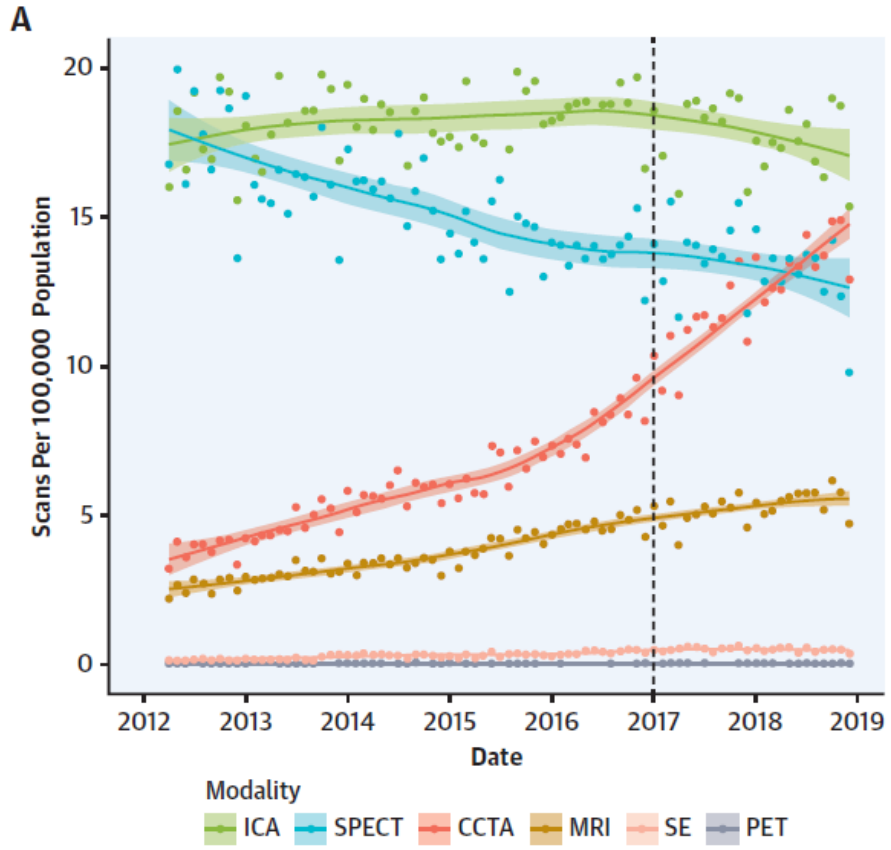
Ά Πανεπιστημιακή Καρδιολογική Κλινική ΑΠΘ, ΠΓΝΘ ΑΧΕΠΑ

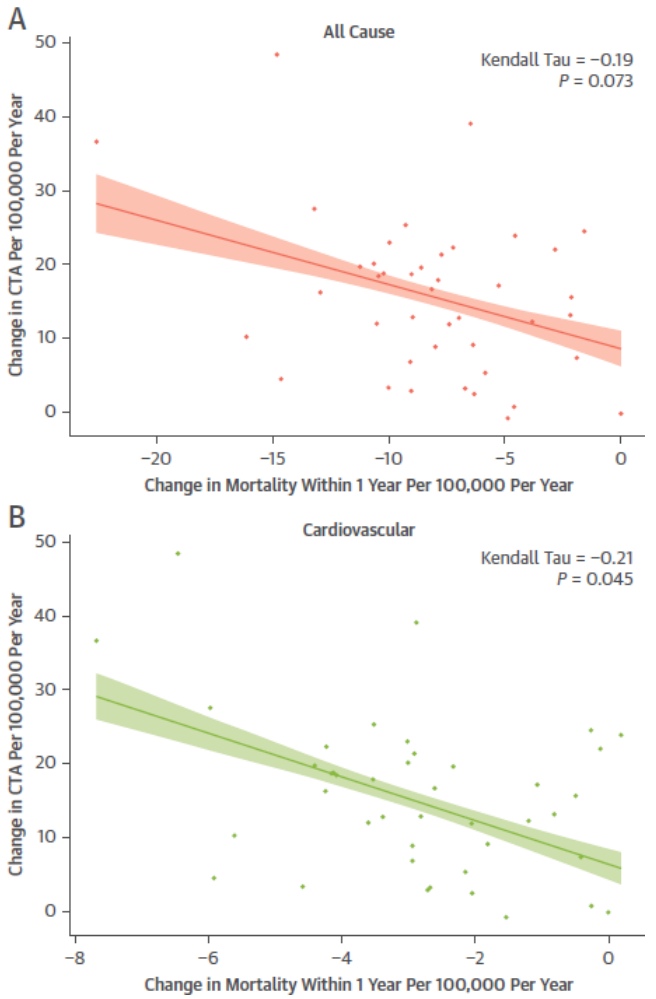
National Trends in Coronary Artery Disease Imaging

Associations With Health Care Outcomes and Costs

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

CENTRAL ILLUSTRATION England-wide Examinations Performed Per Month per 100,000 Population for the Investigation of Coronary Artery Disease From 2012 to 2018





Outline

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

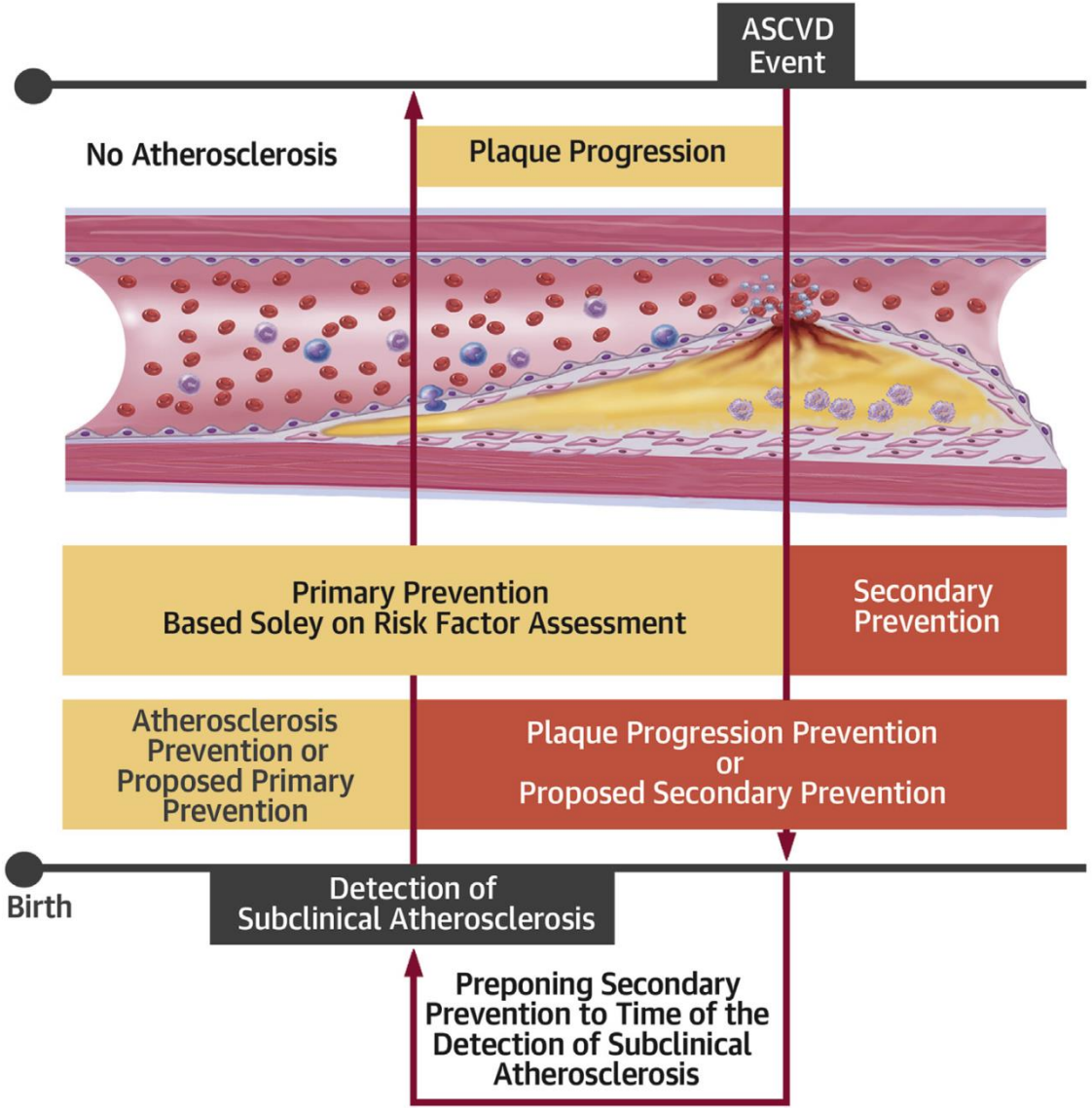
CCTA: 1η γραμμή στην διάγνωση Στεφανιαίας Νόσου

- Σε ασυμπτωματικούς για πρωτογενή πρόληψη
- Σε συμπτωματικούς με χρόνια σταθερή στηθάγχη
- Σε συμπτωματικούς με οξύ προκάρδιο άλγος
- Σε συμπτωματικούς με νέα διάγνωση καρδιακής ανεπάρκειας

CCTA

για εκτίμηση αθηρωμάτωσης

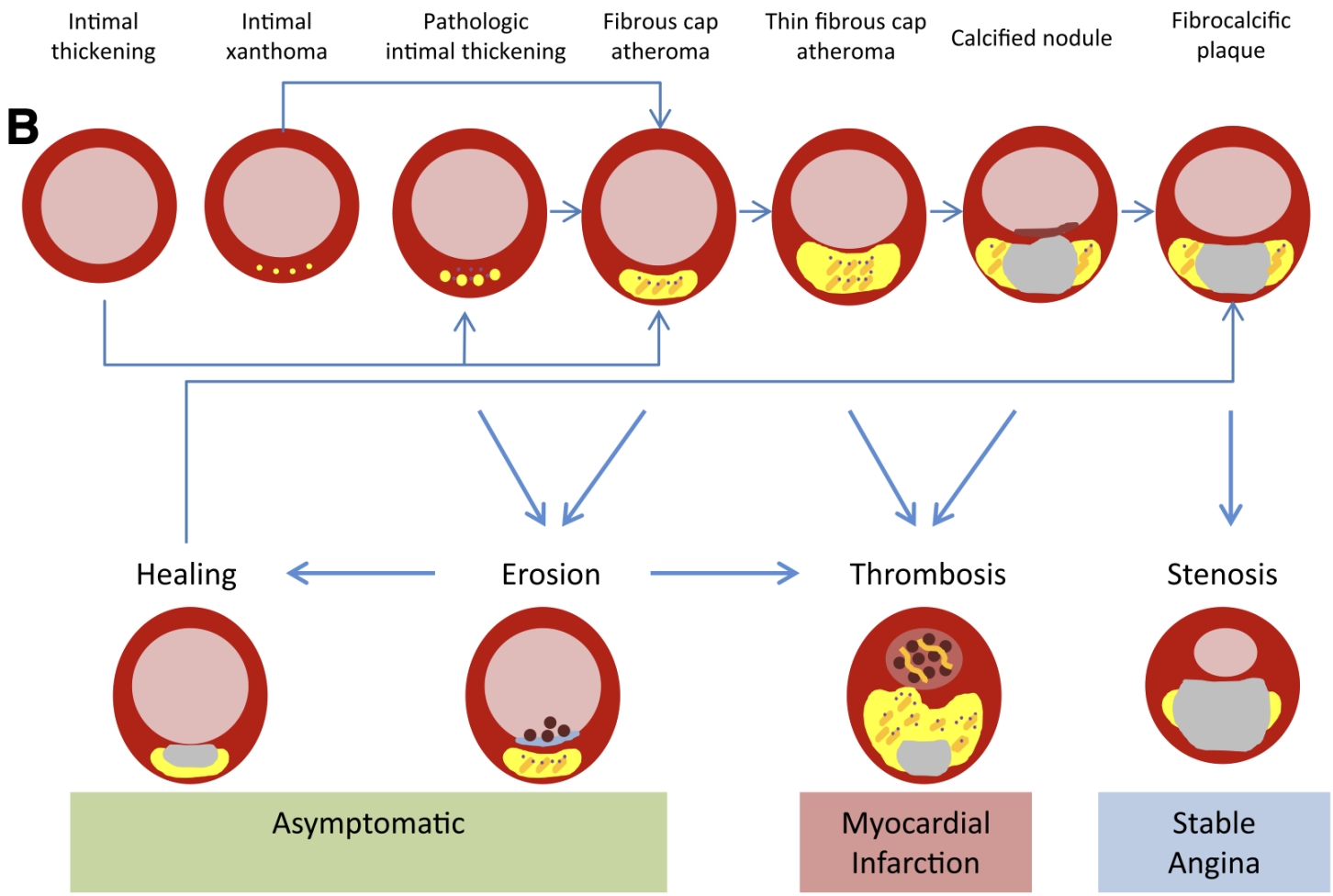
σε **ασυμπτωματικούς** ασθενείς



Natural History of Coronary Artery Disease

Current Practice: Primary and Secondary Prevention

Proposed Approach: Aimed at Halting Plaque Progression


B
Intimal thickening
Intimal xanthoma
Pathologic intimal thickening
Fibrous cap atheroma
Thin fibrous cap atheroma
Calcified nodule
Fibrocalcific plaque
Healing
Erosion
Thrombosis
Stenosis
Asymptomatic
Myocardial Infarction
Stable Angina

Αξονική Στεφανιογραφία

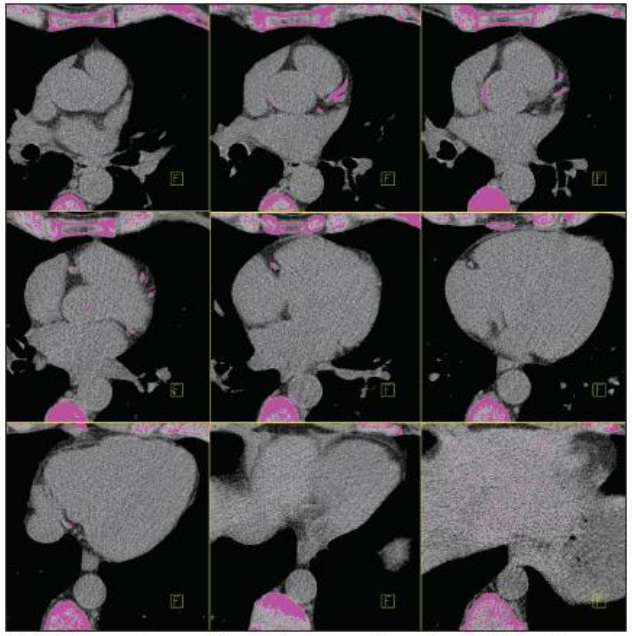
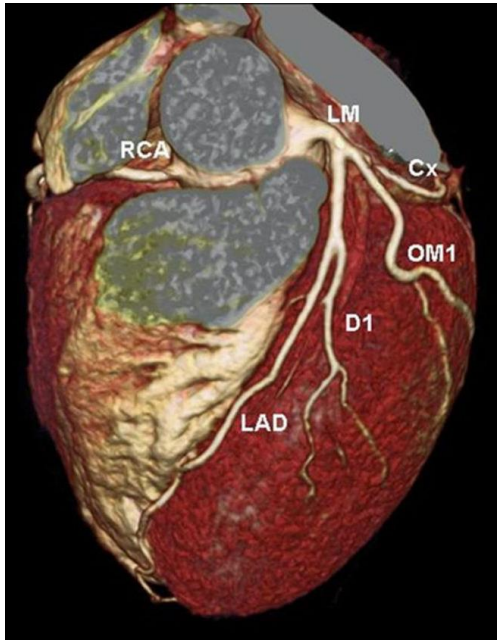
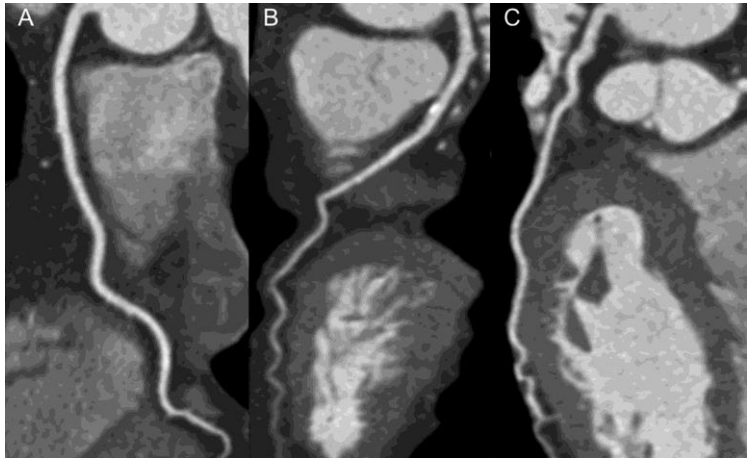
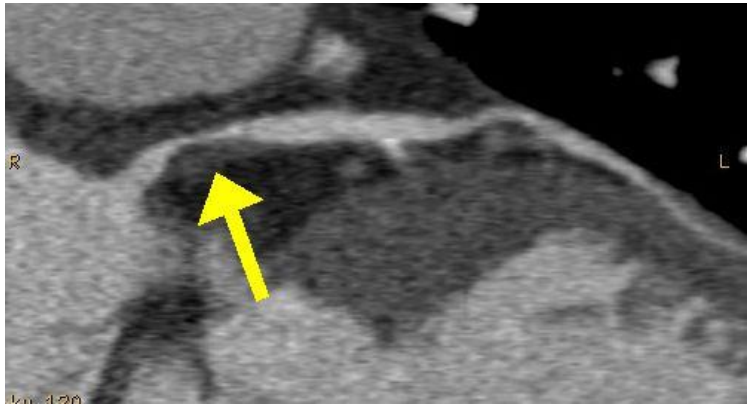


FIGURE 1. Sequence of coronary calcium score images. Appropriate examination technique enables accurate calcium scoring in all coronary segments.







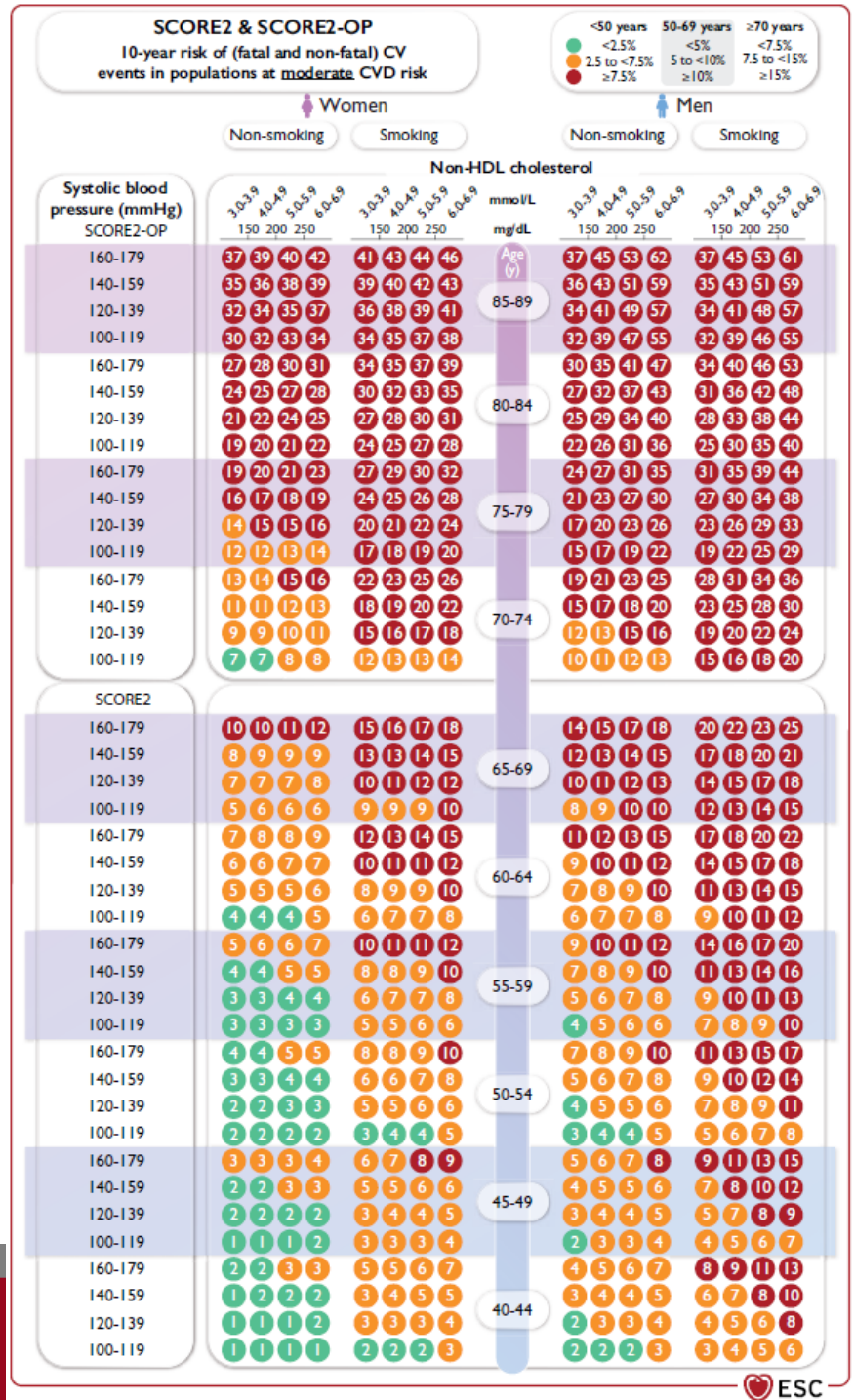


Table 5 Cardiovascular disease risk categories based on SCORE2 and SCORE2-OP in apparently healthy people according to age

	<50 years	50–69 years	≥70 years[a]
Low-to-moderate CVD risk: risk factor treatment generally not recommended	<2.5%	<5%	<7.5%
High CVD risk: risk factor treatment should be considered	2.5 to <7.5%	5 to <10%	7.5 to <15%
Very high CVD risk: risk factor treatment generally recommended[a]	≥7.5%	≥10%	≥15%

© ESC 2021

2024 ESC Guidelines for the management of chronic coronary syndromes

Recommendation Table 27 — Recommendations for screening for coronary artery disease in asymptomatic individuals (see also Evidence Table 27)

Recommendations	Class[a]	Level[b]
Opportunistic screening of healthy individuals for cardiovascular risk factors and to estimate the risk of future cardiovascular events using scoring systems, e.g. SCORE2 and SCORE-OP, is recommended to detect individuals at high risk and guide treatment decisions.[16,1101,1112]	I	C
When coronary artery calcification findings are available from previous chest CT scans, using these findings to enhance risk stratification and guide treatment of modifiable risk factors should be considered.[17,1108–1110]	IIa	C
CACS may be considered to improve risk classification around treatment decision thresholds.[1104–1106]	IIb	C
An ultrasound of the carotid arteries may be considered as an alternative when CACS is unavailable or not feasible to detect atherosclerotic disease and to improve risk classification around treatment decision thresholds.[1111]	IIb	B

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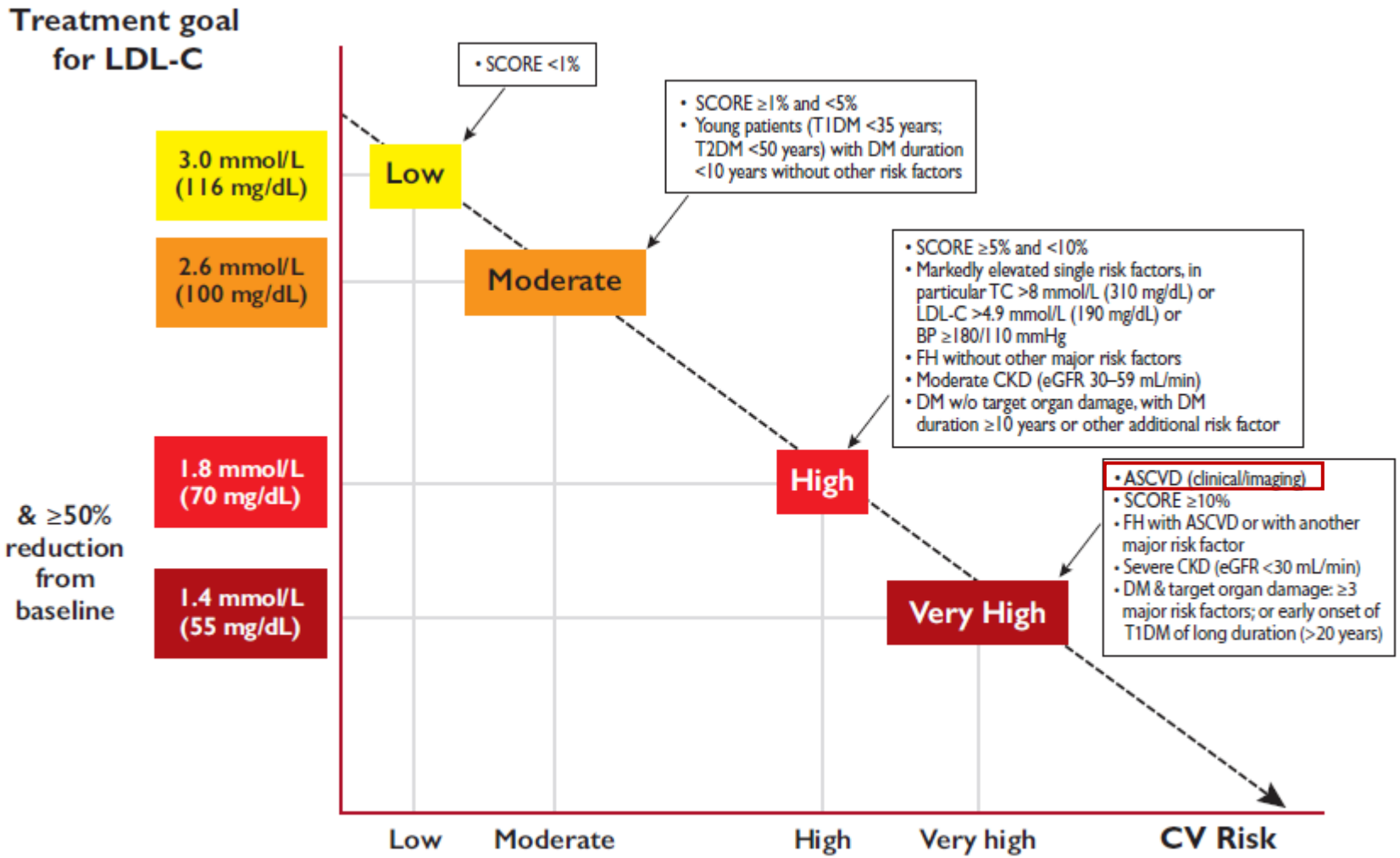
Patients with established ASCVD			
Documented ASCVD, dinical or unequivocal on imaging. Documented clinical ASCVD includes previous AMI, ACS, coronary revascularization and other arterial revascularization procedures, stroke and TIA, aortic aneurysm and PAD. Unequivocally documented ASCVD on imaging includes plaque on coronary angiography or carotid ultrasound or on CTA. It does NOT include some increase in continuous imaging parameters such as intima–media thickness of the carotid artery.	N/A	**Very high-risk**	Residual CVD risk estimation after general prevention goals (e.g. 10-year risk with the SMART risk score for patients with established CVD or 1- or 2-year risk with EUROASPIRE risk score for patients with CHD). Consider lifetime CVD risk and benefit estimation of risk factor treatment (e.g. SMART-REACH model; or DIAL model if diabetes).

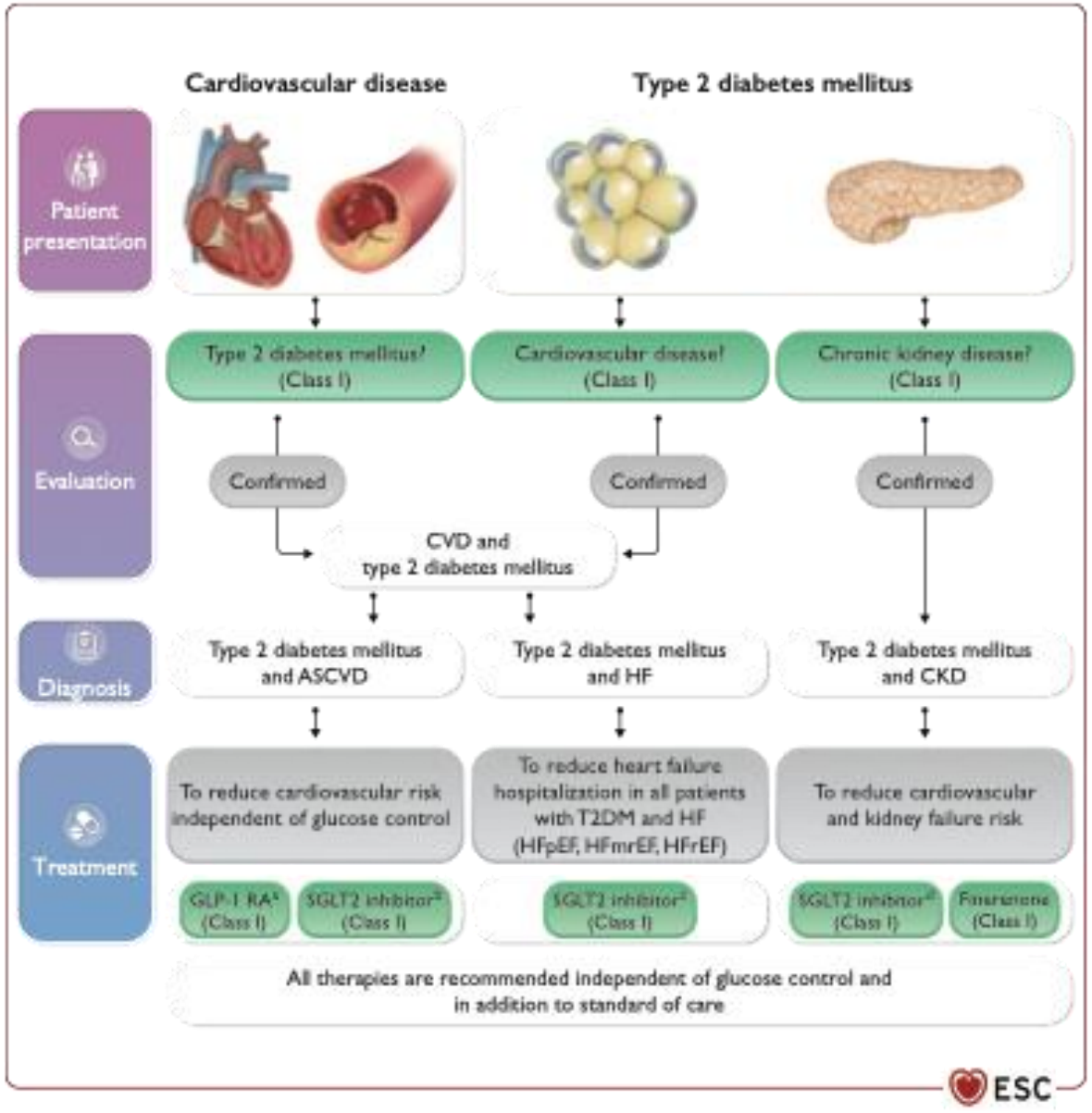
Severe TOD is defined as at least one of:

1. eGFR <45 mL/min/1.73 m2
2. eGFR 46-59 mL/min/1.73 m2 and microalbuminuria (ACR 30300 mg/g or 330 mg/mmol)
3. proteinuria (ACR >300 mg/g or >30 mg/mmol)
4. presence of microvascular disease in at least three different sites
   a) microalbuminuria + b) retinopathy + c) neuropathy

ESC Guidelines. EHJ 2021


Treatment goal for LDL-C
3.0 mmol/L (116 mg/dL)
2.6 mmol/L (100 mg/dL)
1.8 mmol/L (70 mg/dL)
1.4 mmol/L (55 mg/dL)
& ≥50% reduction from baseline
• SCORE <1%
Low
• SCORE ≥1% and <5%
• Young patients (T1DM <35 years; T2DM <50 years) with DM duration <10 years without other risk factors
Moderate
• SCORE ≥5% and <10%
• Markedly elevated single risk factors, in particular TC >8 mmol/L (310 mg/dL) or LDL-C >4.9 mmol/L (190 mg/dL) or BP ≥180/110 mmHg
• FH without other major risk factors
• Moderate CKD (eGFR 30–59 mL/min)
• DM w/o target organ damage, with DM duration ≥10 years or other additional risk factor
High
• ASCVD (clinical/imaging)
• SCORE ≥10%
• FH with ASCVD or with another major risk factor
• Severe CKD (eGFR <30 mL/min)
• DM & target organ damage: ≥3 major risk factors; or early onset of T1DM of long duration (>20 years)
Very High
Low
Moderate
High
Very high
CV Risk

EHJ 2020


Cardiovascular disease
Type 2 diabetes mellitus
Patient presentation
Evaluation
Diagnosis
Treatment
Type 2 diabetes mellitus?
(Class I)
Cardiovascular disease?
(Class I)
Chronic kidney disease?
(Class I)
Confirmed
Confirmed
Confirmed
CVD and type 2 diabetes mellitus
Type 2 diabetes mellitus and ASCVD
Type 2 diabetes mellitus and HF
Type 2 diabetes mellitus and CKD
To reduce cardiovascular risk independent of glucose control
To reduce heart failure hospitalization in all patients with T2DM and HF (HFpEF, HFmrEF, HFrEF)
To reduce cardiovascular and kidney failure risk
GLP-1 RA
(Class I)
SGLT2 inhibitor
(Class I)
SGLT2 inhibitor
(Class I)
SGLT2 inhibitor
(Class I)
Finerenone
(Class I)
All therapies are recommended independent of glucose control and in addition to standard of care
ESC

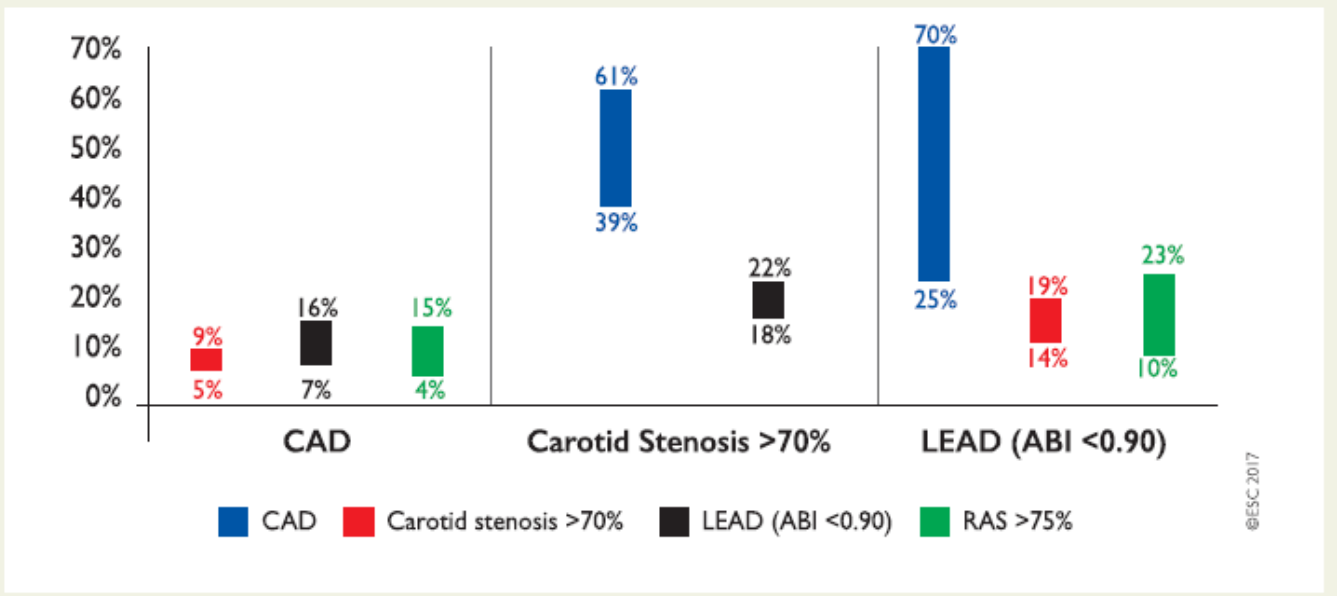


Figure 8 Reported rate ranges of other localizations of atherosclerosis in patients with a specific arterial disease.[51, 335–343] The graph reports the rates of concomitant arterial diseases in patients presenting an arterial disease in one territory (e.g. in patients with CAD, 5 - 9% of cases have concomitant carotid stenosis >70%). ABI = ankle-brachial index; CAD = coronary artery disease; LEAD = lower extremity artery disease; RAS = renal artery stenosis.

Screening for CAD in CEA

In patients undergoing elective CEA, preoperative CAD screening, including coronary angiography, may be considered.[382,383]	IIb	B

EHJ 2017

Contents lists available at ScienceDirect

Journal of Cardiovascular Computed Tomography

journal homepage: www.JournalofCardiovascularCT.com

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

Guidelines

SCCT 2021 Expert Consensus Document on Coronary Computed Tomographic Angiography: A Report of the Society of Cardiovascular Computed Tomography

Jagat Narula [a, 1], Y. Chandrashekhar [b, 1], Amir Ahmadi [a], Suhny Abbara [c], Daniel S. Berman [d], Ron Blankstein [e], Jonathon Leipsic [f], David Newby [g], Edward D. Nicol [h], Koen Nieman [i], Leslee Shaw [j], Todd C. Villines [k], Michelle Williams [g], Harvey S. Hecht [a, *, 1]

Asymptomatic high risk subjects

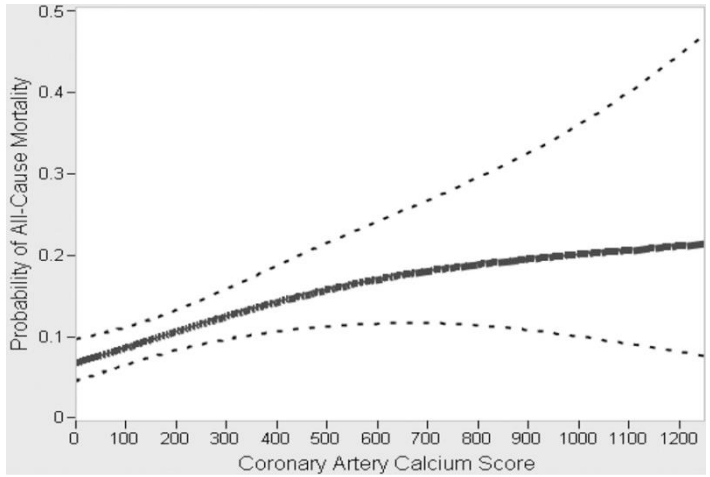
The presence of predominantly non-calcified plaque is more prevalent in young individuals (**age <50 years**) who have:

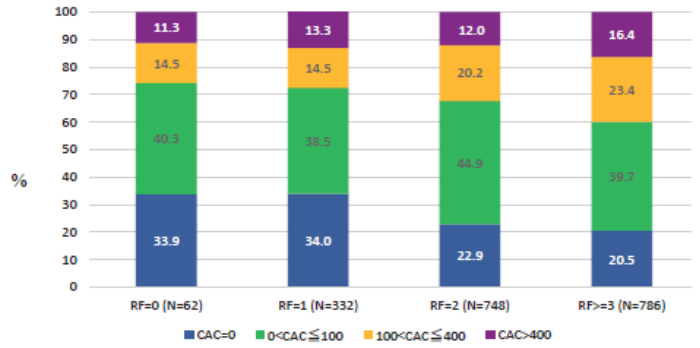
- diabetes,
- smoking,
- familial hypercholesterolemia,
- strong family history of premature ASCVD
- inflammatory conditions (e.g. SLE, RA, or psoriasis),
- HIV,
- those working in high hazard occupations.

Testing of such asymptomatic individuals should be performed in the context of shared decision making, if there is uncertainty regarding the patient's need, or benefit for medical therapies. (i.e. statin therapy, PCSK9 inhibitors).

CAC score predicts long-term CVD outcomes in asymptomatic DM 2.

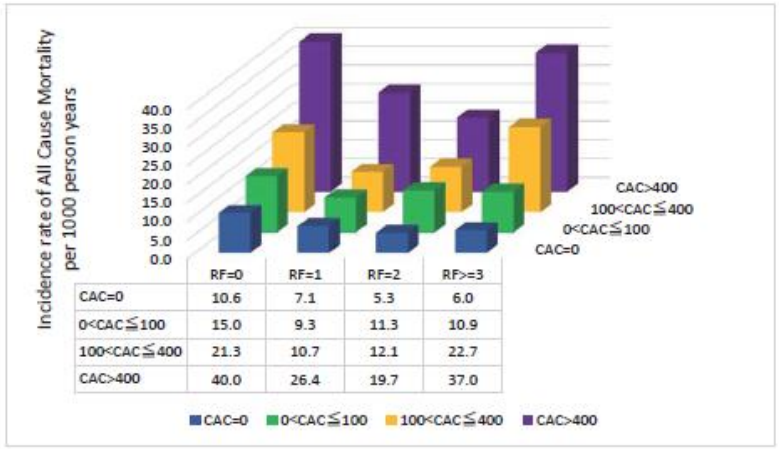
χρδιολογική Κλινική ΑΧΕΠΑ





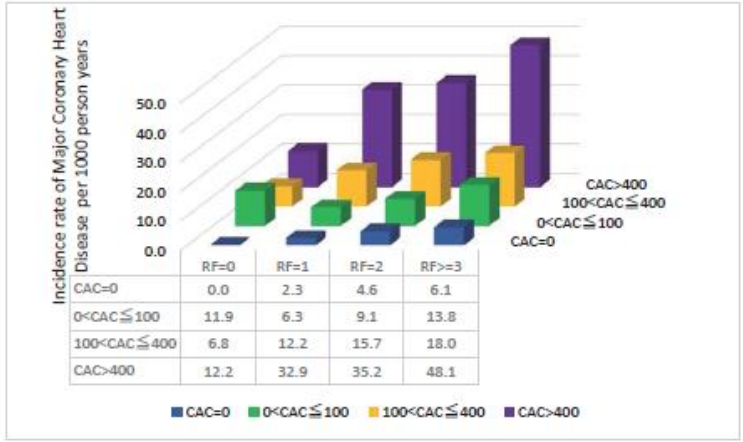
. Distribution of coronary artery calcium (CAC) scores by number of coronary risk factor

A



	RF=0	RF=1	RF=2	RF>=3
CAC=0	10.6	7.1	5.3	6.0
0<CAC≦100	15.0	9.3	11.3	10.9
100<CAC≦400	21.3	10.7	12.1	22.7
CAC>400	40.0	26.4	19.7	37.0

B



	RF=0	RF=1	RF=2	RF>=3
CAC=0	0.0	2.3	4.6	6.1
0<CAC≦100	11.9	6.3	9.1	13.8
100<CAC≦400	6.8	12.2	15.7	18.0
CAC>400	12.2	32.9	35.2	48.1

Fig. 3.

Incidence rates of all-cause mortality (A) and major coronary heart disease (B) among subgroups of risk factor burden and CAC category.

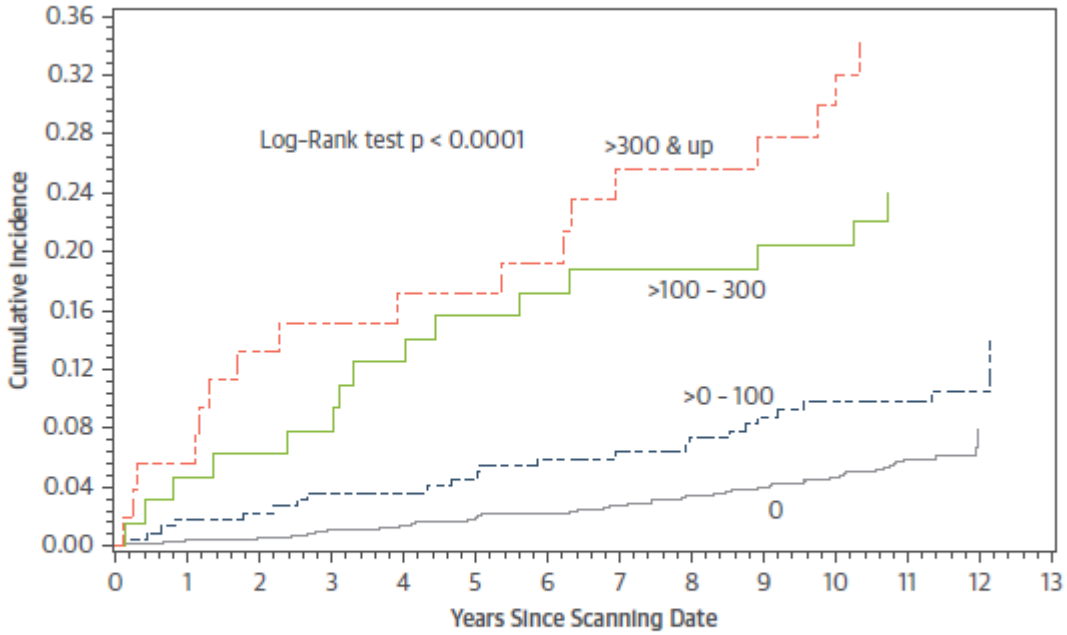
Diabetes Care 2011

J Atheroscler Thromb 2020

The Association of Coronary Artery Calcification With Subsequent Incidence of Cardiovascular Disease in Type 1 Diabetes

The DCCT/EDIC Trials

FIGURE 2 Cardiovascular Events by CAC Score



No. at Risk			
0	817	786	730
>0-100	221	206	185
>100-300	65	54	47
>300	53	40	32

Coronary atherosclerosis scoring with semiquantitative CCTA risk scores for prediction of major adverse cardiac events: A propensity score-based analysis of diabetic and non-diabetic patients

Table 2: CCTA findings of study population.

	DM patients n=732 n (%)	Non-DM patients n=732	p-value
No or non-obstructive CAD	428 (59)	502 (69)	<0.001
Obstructive CAD	304 (42)	230 (31)	<0.001

Table 4: Leiden CCTA risk score and weight scores stratified by DM.

	DM patients n=732 Mean ± SD or n (%)	Non-DM patients n=732	p-value
Leiden CCTA risk score category			<0.001
CCTA risk score 0-5	332 (45)	416 (57)	
CCTA risk score 6-20	314 (43)	268 (37)	
CCTA risk score >20	86 (12)	48 (7)	

Journal Pr

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Journal of Cardiovascular Computed Tomography

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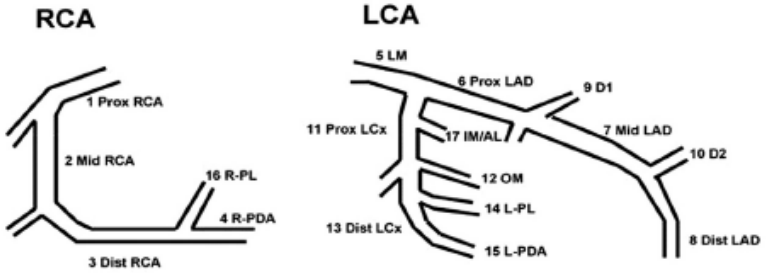
Research paper

Coronary computed tomography angiography derived risk score in predicting cardiac events

Valtteri Uusitalo, MD, PhD [a, d, *, 1], Vasileios Kamperidis, MD, MSc, PhD [e, 1], Michiel A. de Graaf, MSc [e], Teemu Maaniitty, BM [a], Iida Stenström, BM [a], Alexander Broersen, MSc, PhD [f], Jouke Dijkstra, MSc, PhD [f], Arthur J. Scholte, MD, PhD [e], Antti Saraste, MD, PhD [a, b], Jeroen J. Bax, MD, PhD [e], Juhani Knuuti, MD, PhD [a, c]



Segment Weight Factor

Segment	Right Dominant	Left Dominant
LM	5	6
Prox LAD	3.5	3.5
Mid LAD	2.5	2.5
Dist LAD	1	1
D1	1	1
D2	0.5	0.5
Prox LCx	1.5	2.5
Dist LCx	1	1.5
AL/IM	1	1
OM	1	1
L-PL	0.5	0.5
L-PDA	0	1
Prox RCA	1	0
Mid RCA	1	0
Dist RCA	1	0
R-PL	0.5	0
R-PDA	1	0

Stenosis Weight Factor

<50%	1
≥50%	1.4

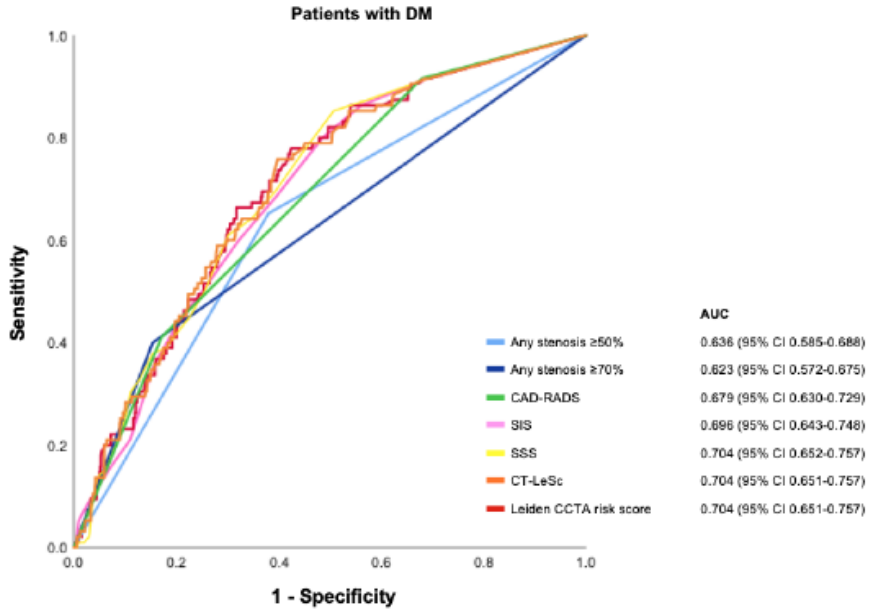
Plaque Weight Factor

Calcified	1.2
Partially Calcified	1.6
Non-Calcified	1.7

Segement(n) Score =

Plaque Weight Factor
X
Stenosis Weight Factor
X
Segment (n) Weigt Factor

CTA Risk Score = Σ Segment (1-17) Score

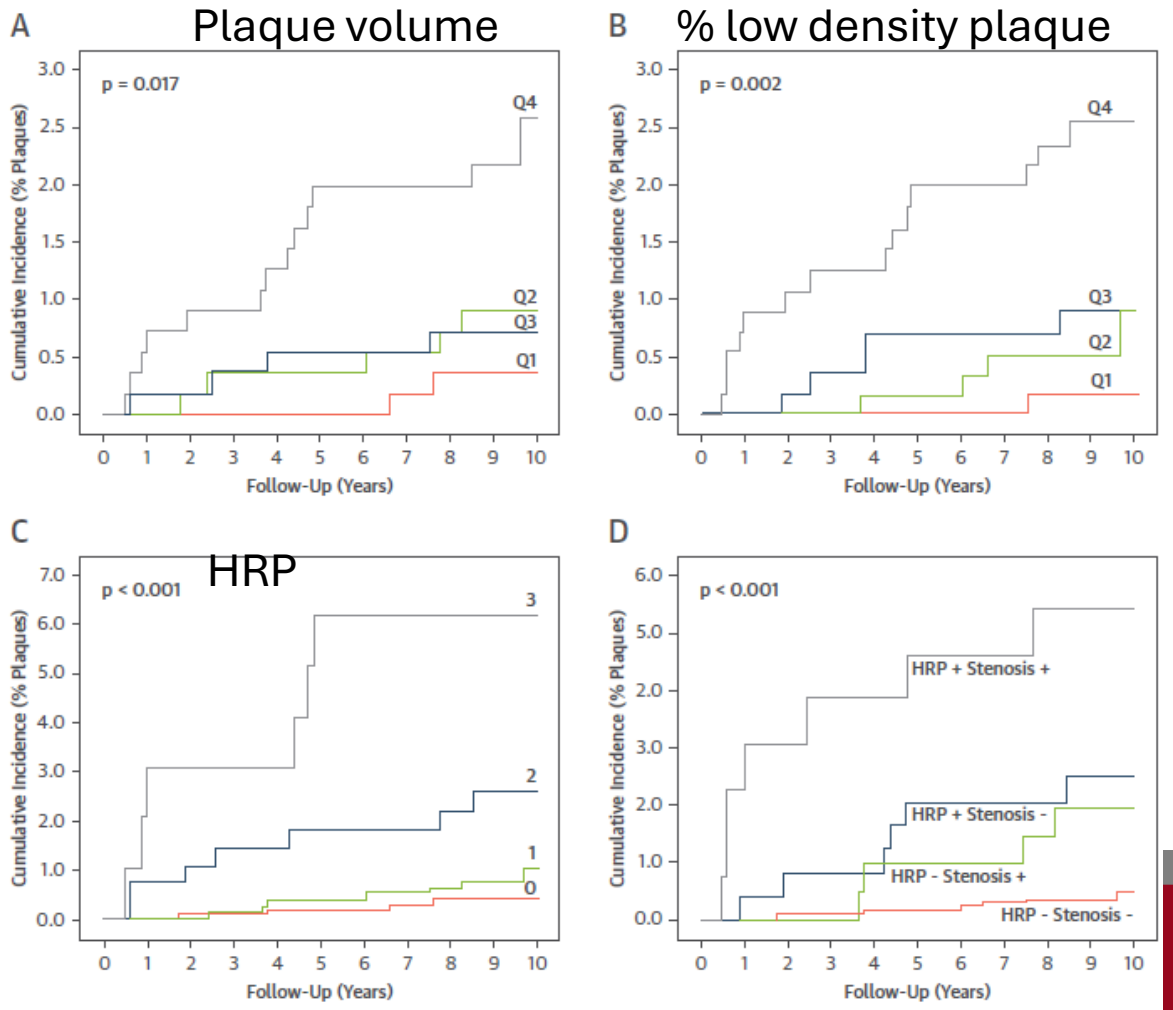


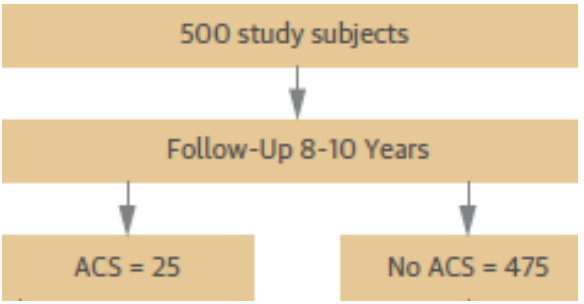
Plaque Morphology as Predictor of Late Plaque Events in Patients With Asymptomatic Type 2 Diabetes

A Long-Term Observational Study

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

FIGURE 2 ACS Culprit Plaque Events

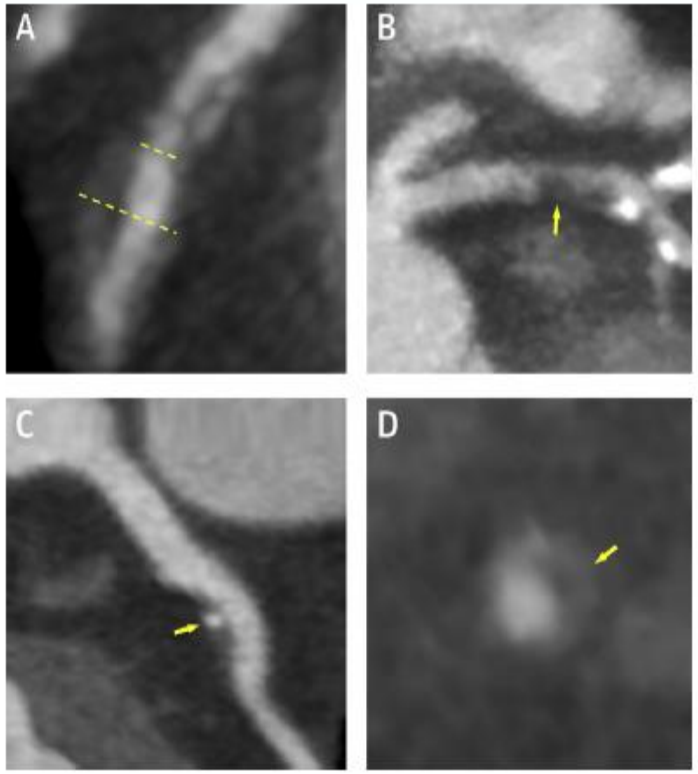


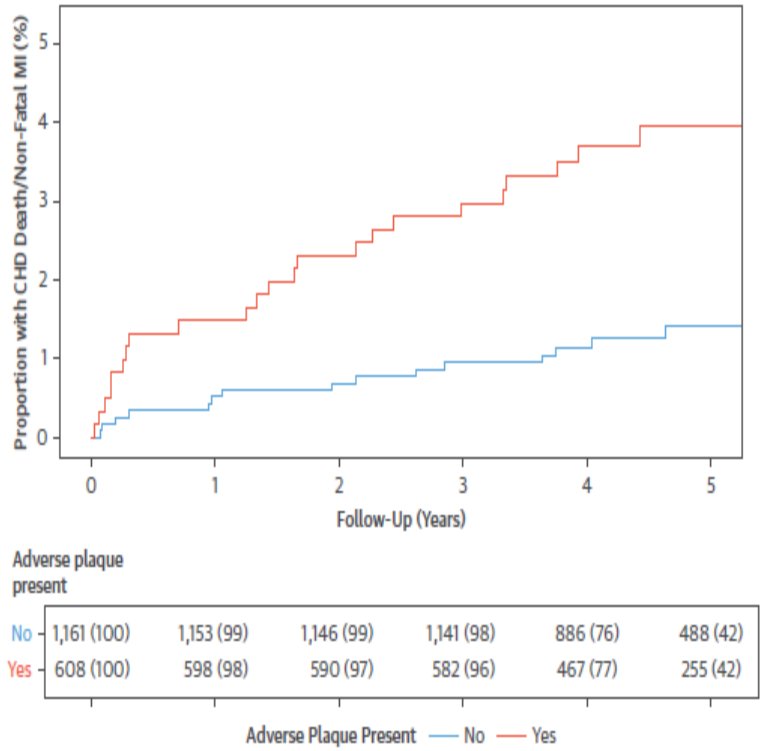


JACC Im 2019

Coronary Artery Plaque Characteristics Associated With Adverse Outcomes in the SCOT-HEART Study

FIGURE 1 Coronary Plaque Characteristics Identified on Computed Tomography Coronary Angiography





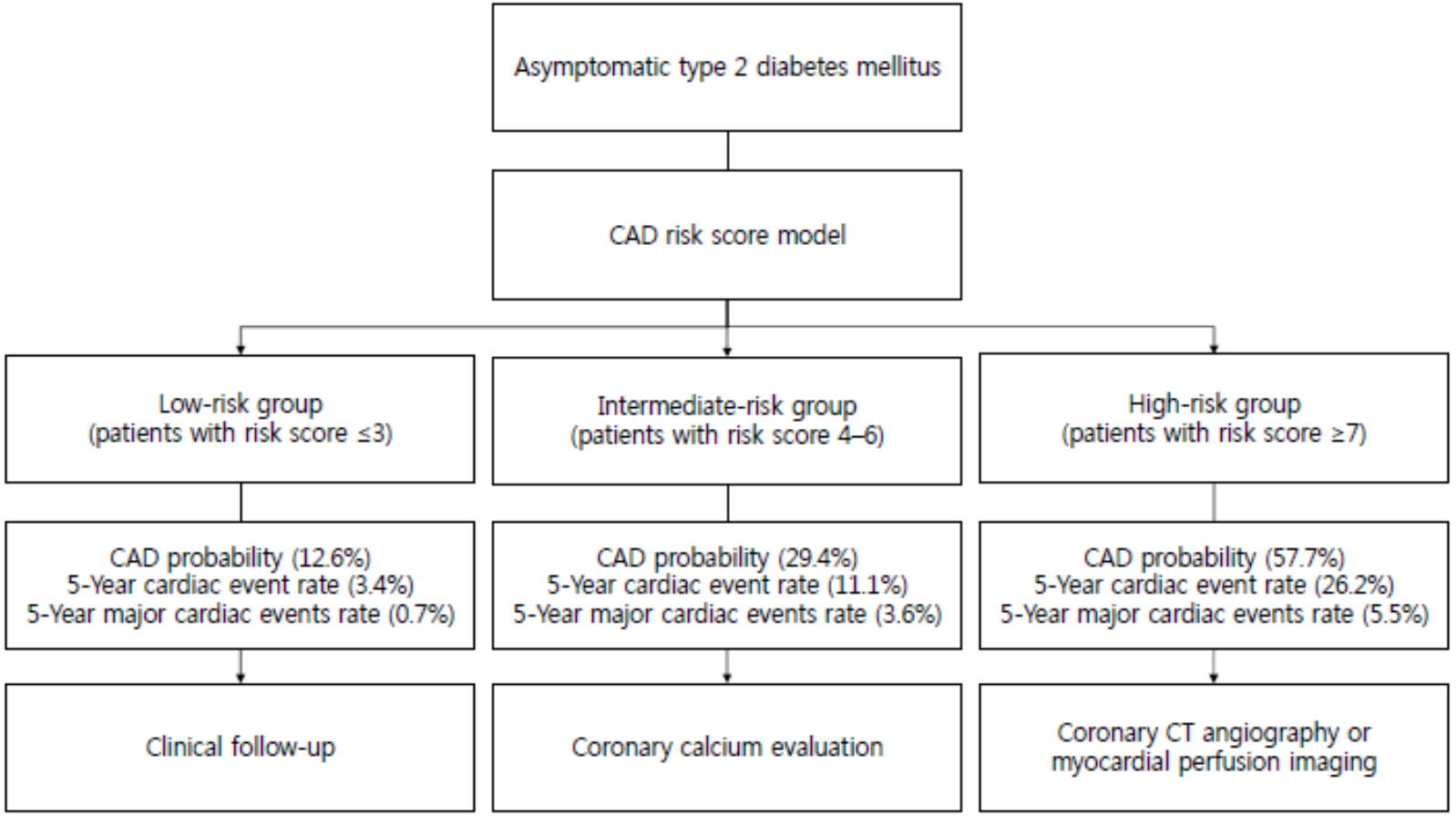


Fig. 2. Proposed algorithm for individualized coronary artery disease (CAD) screening in asymptomatic type 2 diabetes mellitus

Prognostic value of coronary computed tomographic angiography findings in asymptomatic individuals: a 6-year follow-up from the prospective multicentre international CONFIRM study

N=1226 asymptomatic patients

Table 3 Comparison of performance of coronary computed tomographic angiography over traditional risk factors alone and traditional risk factor plus coronary artery calcium scoring in predicting long-term risk of all-cause mortality using likelihood ratio tests

Models	LR incremental χ^2			
	Compared with traditional RF alone	*P*-value	Compared with CACS + traditional RF	*P*-value
Baseline models				
Traditional RF	NA	NA	NA	NA
Traditional RF + CACS	20.40	<0.001	NA	NA
Adding degree of stenosis Information by CCTA				
No. of segments with any stenosis	26.05	<0.001	5.65	0.059
No. of segments with stenosis ≥50%	25.43	<0.001	5.03	0.080
No. of vessels with stenosis ≥50%	30.09	<0.001	9.69	0.046
Adding plaque characterization Information by CCTA				
No. of segments with calcified plaques	20.70	<0.001	0.30	0.860
No. of segments with NCP or mixed plaque	23.26	<0.001	2.86	0.240
Adding plaque location information by CCTA				
No. of proximal segment with any stenosis	25.52	<0.001	5.12	0.080
No. of proximal segment with stenosis ≥50%	25.50	<0.001	5.10	0.080

CACS, coronary artery calcium scoring; CCTA, coronary CT angiography; LR, likelihood ratio; NCP, non-calcified plaque; NA, not applicable; RF, risk factors (covariates in the Framingham risk score such as age, gender, smoking status, total cholesterol, high-density lipoprotein cholesterol, blood pressure and treatment for hypertension).

EHJ 2018

Subclinical Coronary Atherosclerosis and Risk for Myocardial Infarction in a Danish Cohort

DANISH study

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

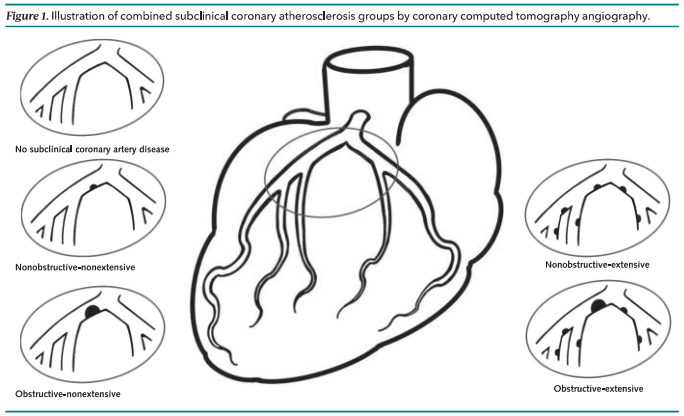
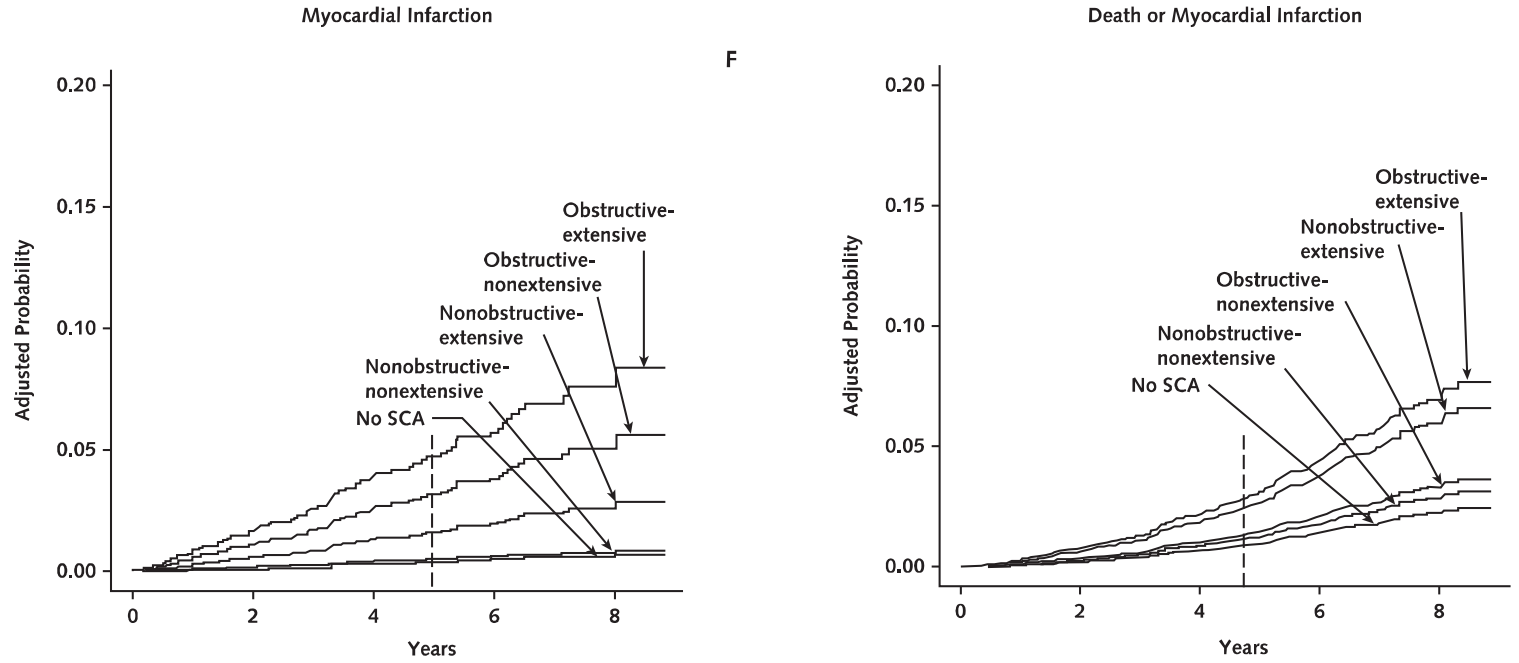


Figure 1. Illustration of combined subclinical coronary atherosclerosis groups by coronary computed tomography angiography.

34% had non-obstructive CAD
10% had obstructive CAD



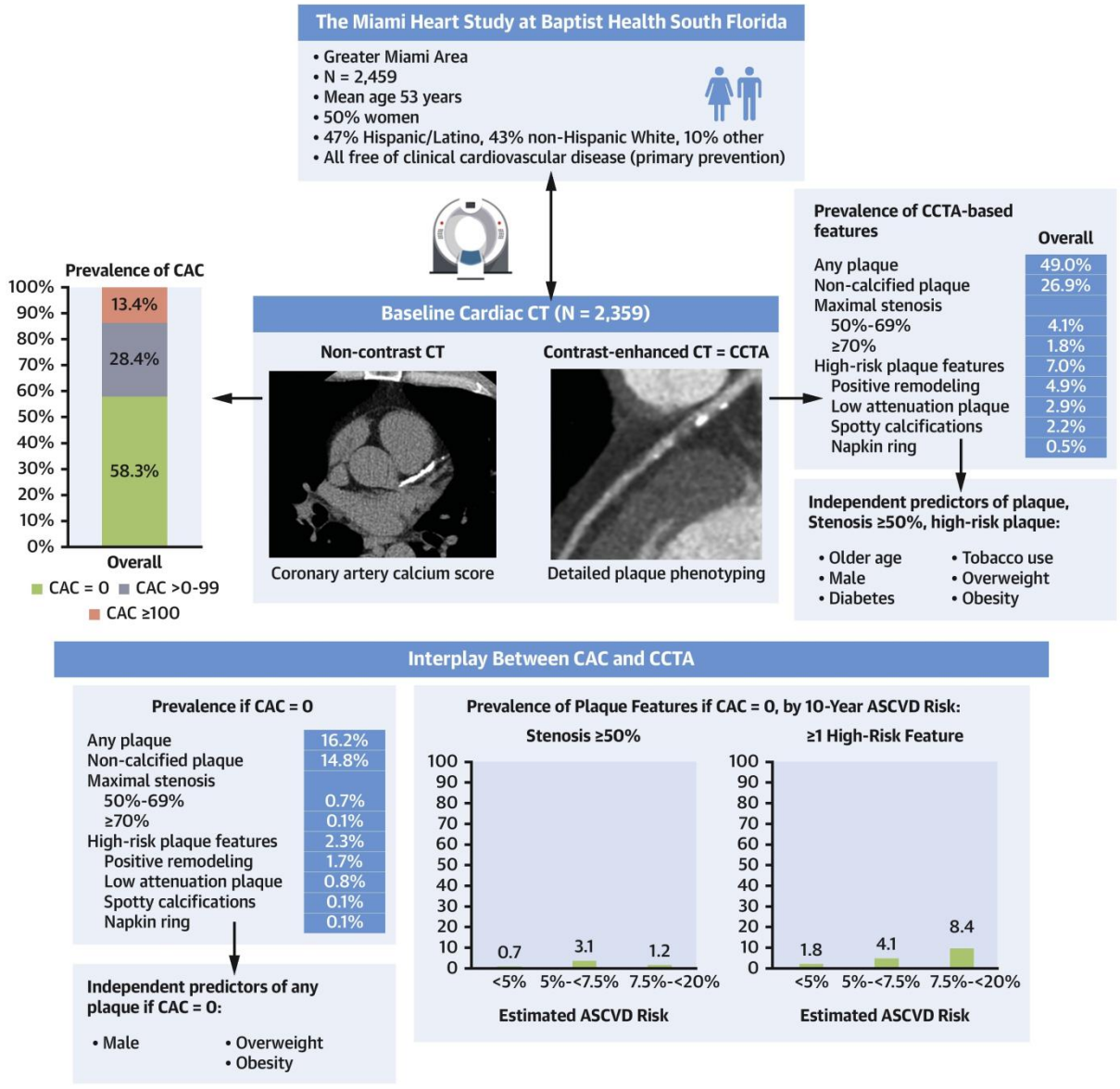
Obstructive-extensive	495	404	347	277	220	176	142	65	30
Obstructive-nonextensive	441	380	333	290	257	211	160	87	30
Nonobstructive-extensive	509	376	291	235	189	156	134	79	30
Nonobstructive-nonextensive	2974	2266	1857	1540	1316	1083	895	570	243
No SCA	5114	4013	3361	2857	2545	2128	1753	1107	377

Obstructive-extensive	495	404	347	277	220	176	142	65	30
Obstructive-nonextensive	441	380	333	290	257	211	160	87	30
Nonobstructive-extensive	509	376	291	235	189	156	134	79	30
Nonobstructive-nonextensive	2974	2266	1857	1540	1316	1083	895	570	243
No SCA	5114	4013	3361	2857	2545	2128	1753	1107	377

Annals Int Med 2023

MIAMI study

CENTRAL ILLUSTRATION: Coronary Artery Calcium Scores and Coronary Computed Tomography Angiography-Based Plaque in the Miami Heart Study



Nasir K, et al. J Am Coll Cardiol Img. 2022;15(9):1604-1618.

CAD Severity on Cardiac CTA Identifies Patients With Most Benefit of Treating LDL Cholesterol to ACC/AHA and ESC/EAS Targets

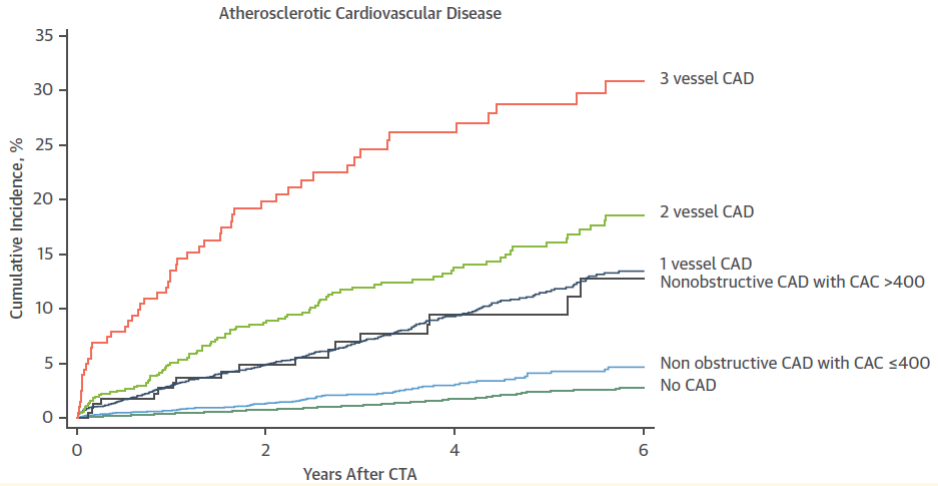
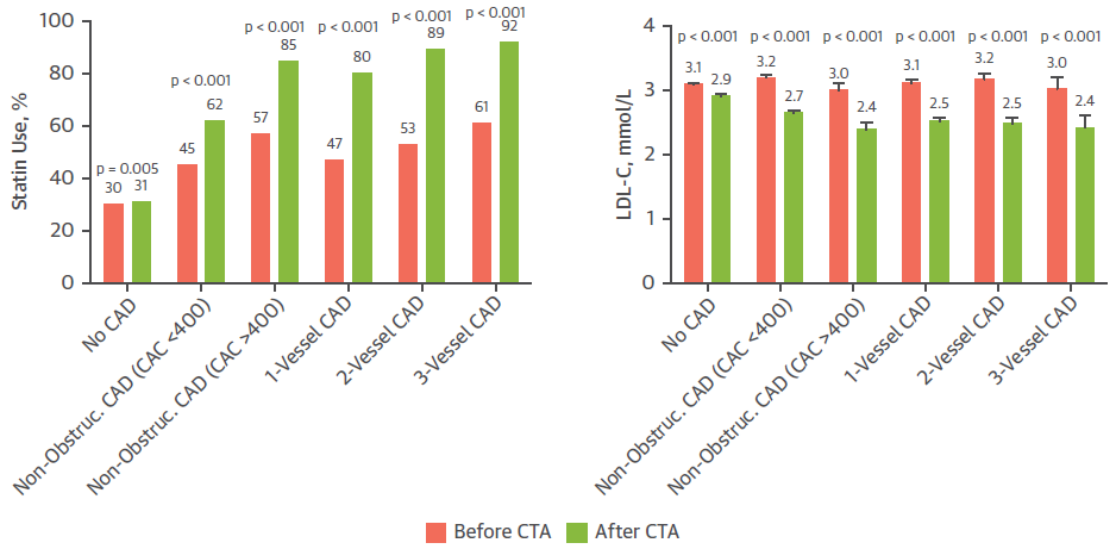
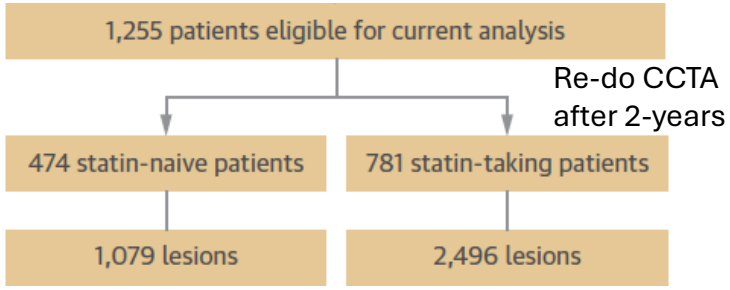


FIGURE 4 Change in Statin Use and LDL-C Levels After CTA



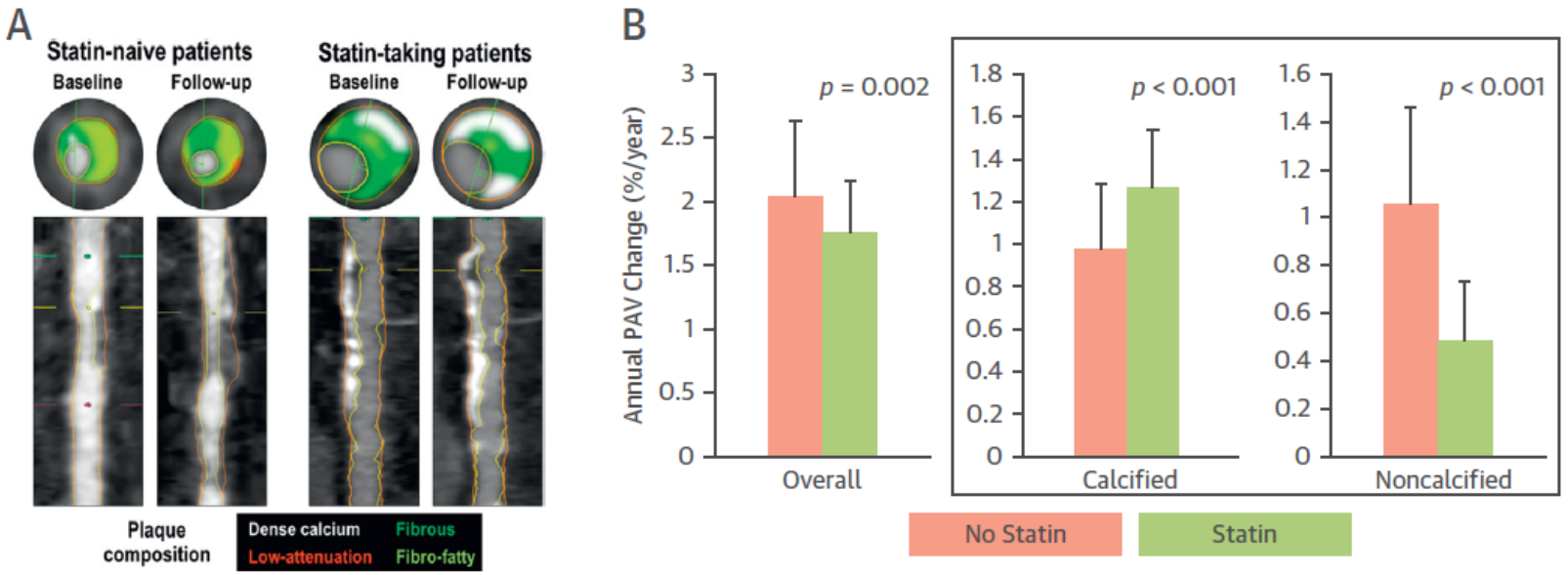
Effects of Statins on Coronary Atherosclerotic Plaques

The PARADIGM Study



Ά Καρδιολογική Κλινική ΑΧΕΠΑ

FIGURE 2 Temporal Changes in Composition of Noncalcified Plaque Volumes According to Statin



(A) Representative coronary computed tomography angiography images of lesions at baseline and follow-up. **(B)** Annualized change in percent atheroma volume (PAV) and PAV by composition according to statin. Annualized change in PAV per lesion was lower in statin-taking patients **(green bars)** than in statin-naive patients **(pink bars)**, driven from slower progression of noncalcified PAV. Noncalcified PAV is the summation of fibrous, fibro-fatty, and low-attenuation PAV.

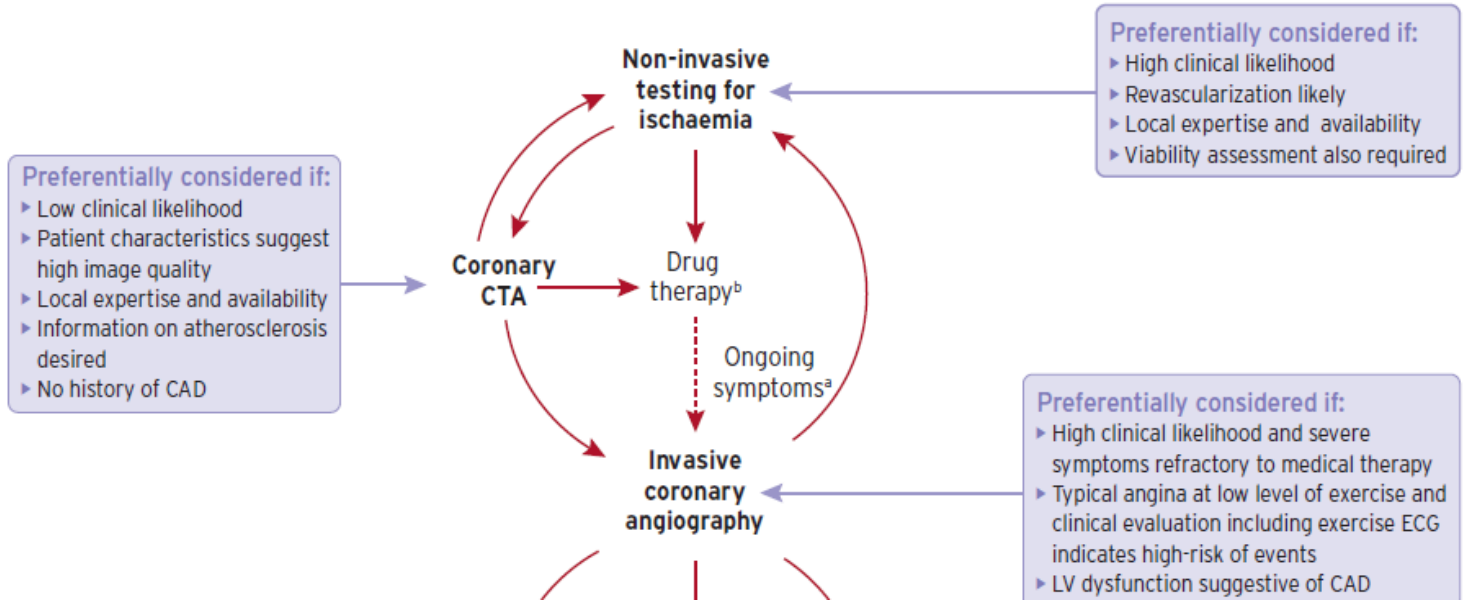
Lee. JACC 2018

CCTA

σε ασθενείς με χρόνια σταθερή στηθάγχη

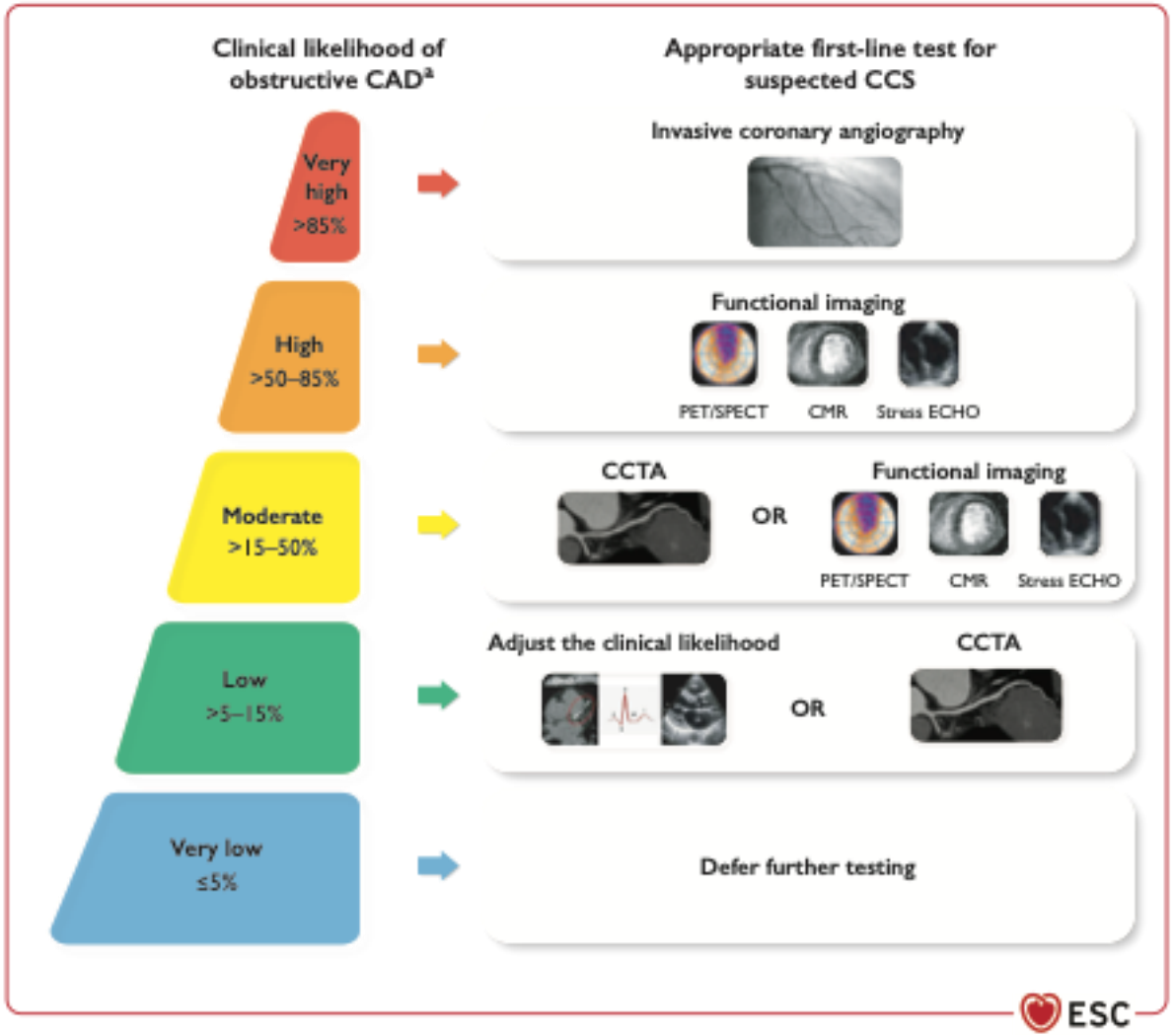
Symptomatic Patient

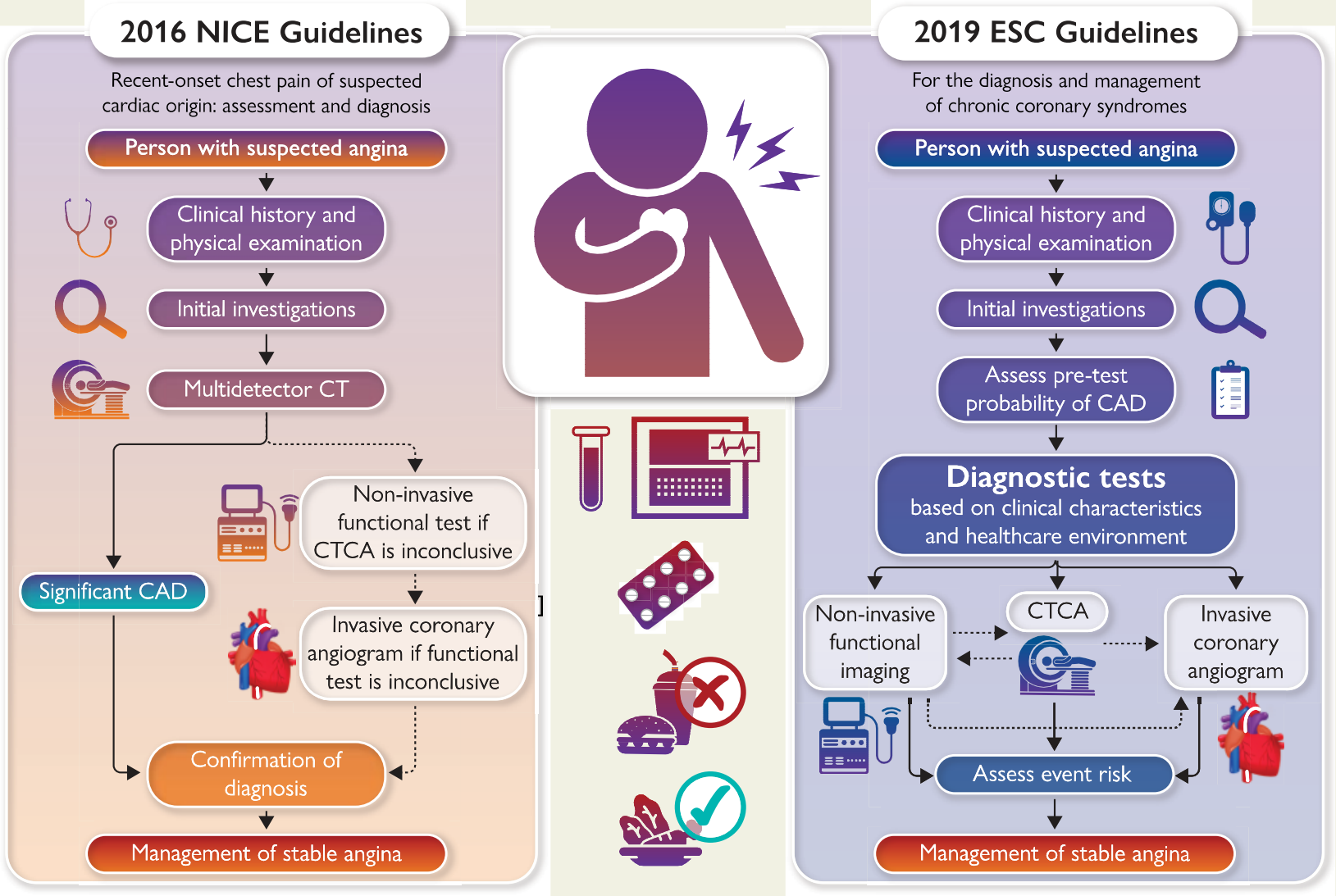
New major recommendations in 2019	
Basic testing, diagnostics, and risk assessment	
Non-invasive functional imaging for myocardial ischaemia or coronary CTA is recommended as the initial test for diagnosing CAD in symptomatic patients in whom obstructive CAD cannot be excluded by clinical assessment alone.	I
It is recommended that selection of the initial non-invasive diagnostic test be based on the clinical likelihood of CAD and other patient characteristics that influence test performance, local expertise, and the availability of tests.	I
Functional imaging for myocardial ischaemia is recommended if coronary CTA has shown CAD of uncertain functional significance or is not diagnostic.	I



ESC Guidelines, EHJ 2019

2024 ESC Guidelines for the management of chronic coronary syndromes




2016 NICE Guidelines
Recent-onset chest pain of suspected cardiac origin: assessment and diagnosis
Person with suspected angina
Clinical history and physical examination
Initial investigations
Multidetector CT
Non-invasive functional test if CTCA is inconclusive
Significant CAD
Invasive coronary angiogram if functional test is inconclusive
Confirmation of diagnosis
Management of stable angina
2019 ESC Guidelines
For the diagnosis and management of chronic coronary syndromes
Person with suspected angina
Clinical history and physical examination
Initial investigations
Assess pre-test probability of CAD
Diagnostic tests
based on clinical characteristics and healthcare environment
Non-invasive functional imaging
CTCA
Invasive coronary angiogram
Assess event risk
Management of stable angina

Coronary CT Angiography and 5-Year Risk of Myocardial Infarction

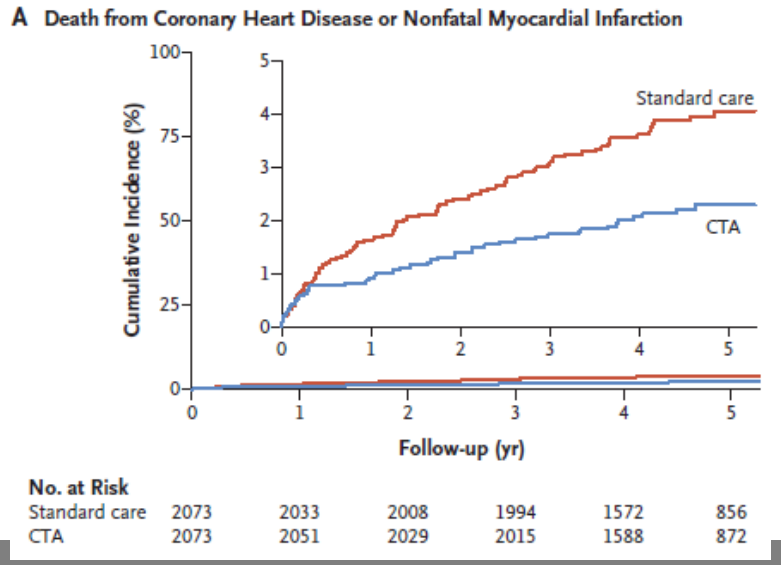
The SCOT-HEART Investigators*

NEJM 2018

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

Stable chest pain who had been referred by a physician to an outpatient cardiology clinic

End Point	All Participants (N=4146)	Standard Care (N=2073)	Standard Care plus CTA (N=2073)	Hazard Ratio (95% CI)†
	number of patients (percent)			
Primary end point: death from CHD or non-fatal myocardial infarction‡	129 (3.1)	81 (3.9)	48 (2.3)	0.59 (0.41–0.84)§



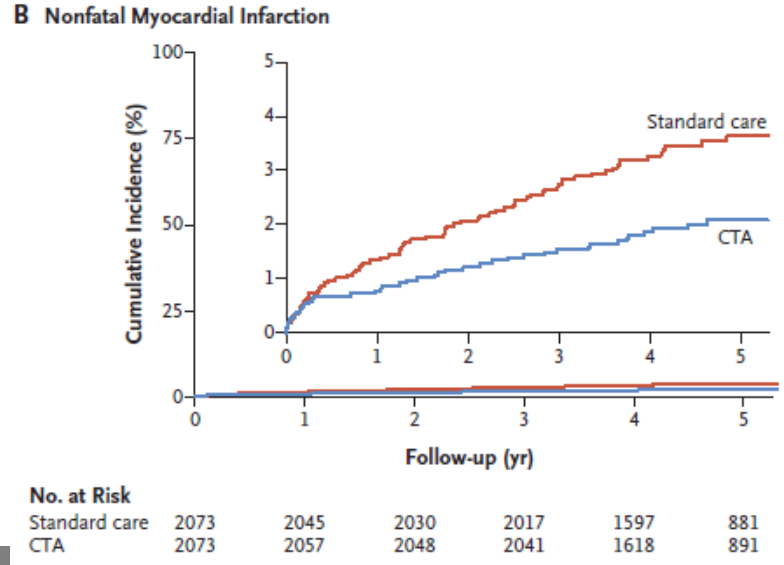
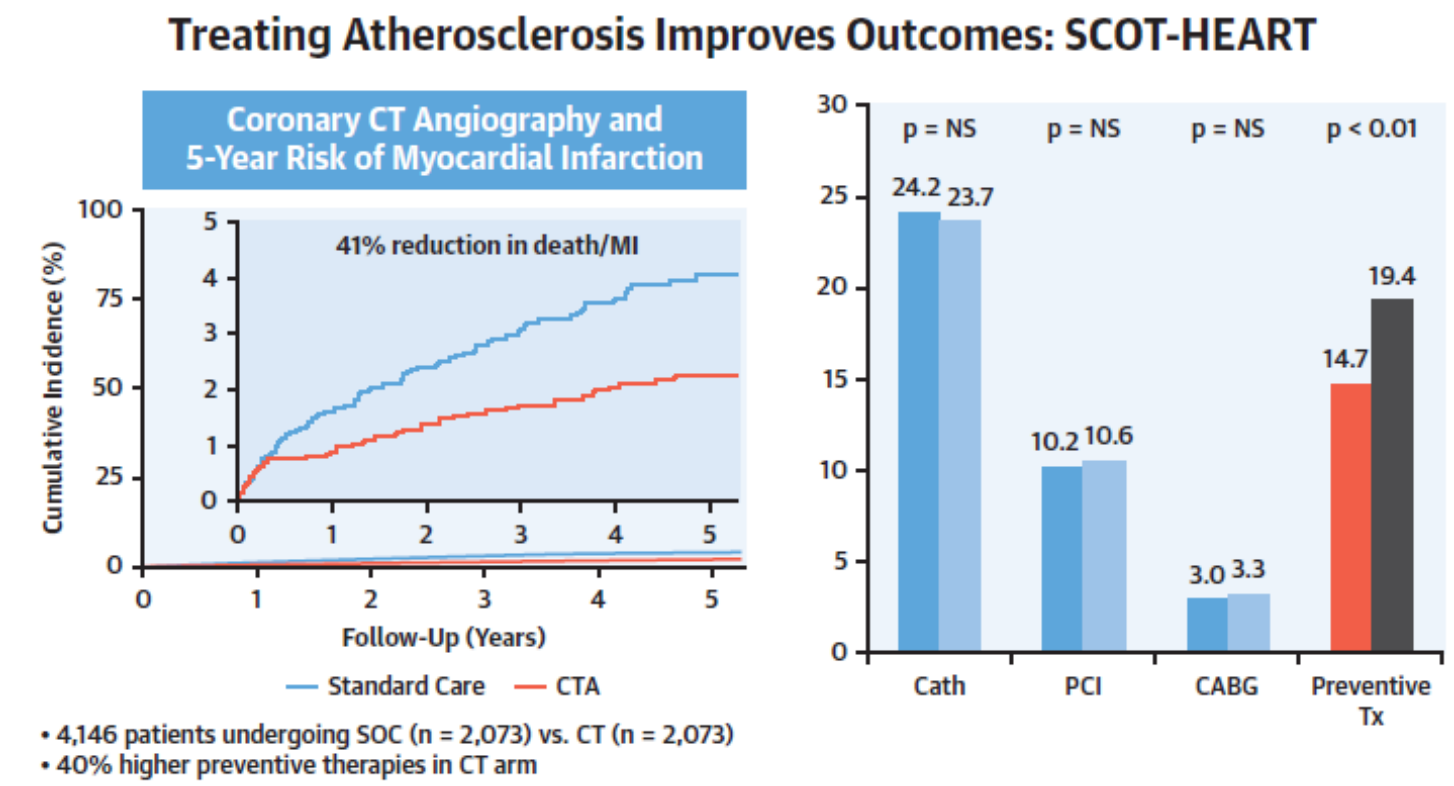


FIGURE 1 The SCOT-HEART Trial



A coronary computed tomography (CT) angiography–first approach resulted in a 41% reduction in cardiac death and myocardial infarction (MI) and significantly more early initiation of preventive therapy (Tx). CABG = coronary artery bypass graft; Cath = catheterization; CTA = computed tomography angiography; NS = not significant; PCI = percutaneous coronary intervention; SCOT-HEART = Scottish Computed Tomography of the Heart; SOC = standard of care. Reprinted with permission from Newby et al. (1).

Coronary CT angiography-guided management of patients with stable chest pain: 10-year outcomes from the SCOT-HEART randomised controlled trial in Scotland

*Michelle C Williams, Ryan Wereski, Christopher Tuck, Philip D Adamson, Anoop S V Shah, Edwin J R van Beek, Giles Roditi, Colin Berry, Nicholas Boon, Marcus Flather, Steff Lewis, John Norrie, Adam D Timmis, Nicholas L Mills, Marc R Dweck, David E Newby, on behalf of the SCOT-HEART Investigators**

Α Καρδιολογική Κλινική ΑΧΕΠΑ

	Standard care (n=2073)	CCTA and standard care (n=2073)	HR (95% CI)	p value
Primary outcome				
Coronary heart disease death or non-fatal myocardial infarction	171 (8·2%)	137 (6·6%)	0·79 (0·63–0·99)	0·044
Secondary outcomes				
All-cause death	166 (8·0%)	168 (8·1%)	1·01 (0·82–1·25)	0·93
Coronary heart disease death	62 (3·0%)	60 (2·9%)	0·97 (0·68–1·38)	0·85
Cardiovascular death	89 (4·3%)	85 (4·1%)	0·95 (0·71–1·28)	0·75
Non-fatal myocardial infarction	124 (6·0%)	90 (4·3%)	0·72 (0·55–0·94)	0·017
Non-fatal ischaemic stroke	52 (2·5%)	40 (1·9%)	0·77 (0·51–1·16)	0·21
Major adverse cardiovascular events*	214 (10·3%)	172 (8·3%)	0·80 (0·65–0·97)	0·026
Procedures				
Invasive coronary angiography	575 (27·7%)	554 (26·7%)	0·96 (0·86–1·08)	0·55
Coronary revascularisation	318 (15·3%)	315 (15·2%)	1·00 (0·86–1·17)	0·99
Percutaneous coronary intervention	255 (12·3%)	249 (12·0%)	0·98 (0·83–1·17)	0·86
Coronary artery bypass grafting	73 (3·5%)	80 (3·9%)	1·10 (0·80–1·51)	0·56

CCTA=coronary CT angiography. HR=hazard ratio. *Coronary heart disease death, non-fatal myocardial infarction, or non-fatal stroke.

Table 2: **Clinical outcomes at 10 years**

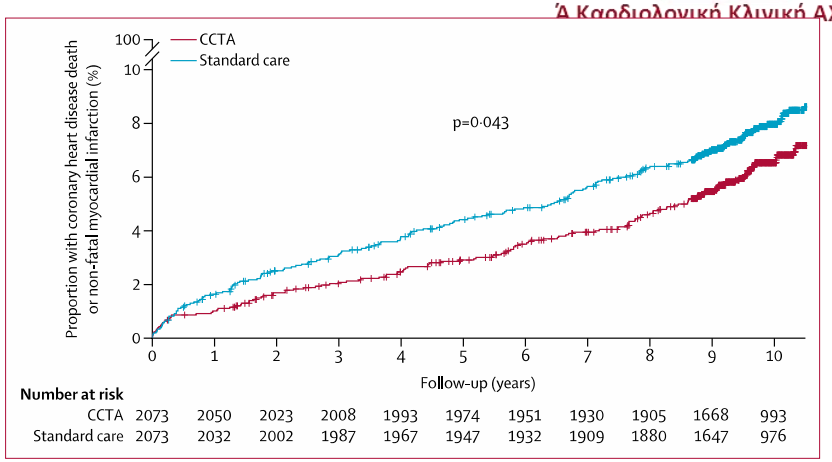
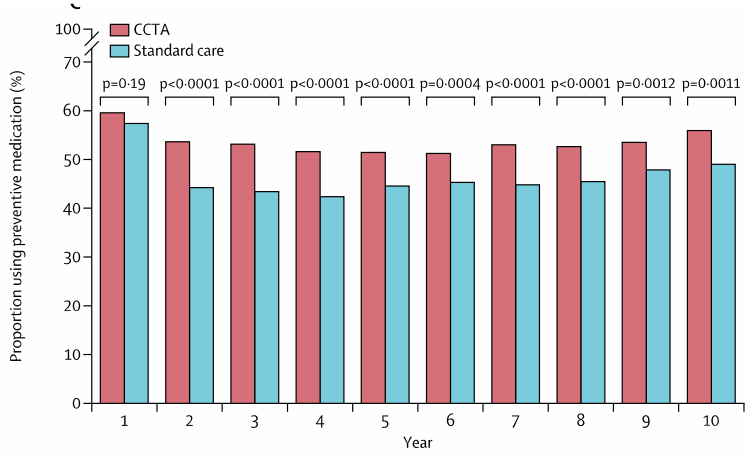


Figure 2: **Cumulative incidence for the primary outcome of coronary heart disease death and non-fatal myocardial infarction**
P value indicates the log-rank test. CCTA=coronary CT angiography.



Outcomes of Anatomical versus Functional Testing for Coronary Artery Disease

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

NEJM 2015 PROMISE Investigators*

randomly assigned 10,003 symptomatic patients to a strategy of initial
A. anatomical testing (CCTA)
or B. functional testing (exercise ECG, nuclear stress testing, or stress ECHO).

End Point	CTA Strategy (N=4996)	Functional-Testing Strategy (N=5007)	Adjusted Hazard Ratio (95% CI)	P Value
Test-related end point				
Invasive catheterization showing no obstructive CAD — no. (%)	170 (3.4)	213 (4.3)	—	0.02
Cumulative radiation exposure in all procedures ≤90 days after randomization — mSv				
All patients	12.0±8.5	10.1±9.0	—	<0.001
Median	10.0	11.3		
Interquartile range	5.6–17.2	0.0–13.5		
Intended functional test before randomization				
Nuclear stress testing	12.0±8.4	14.1±7.6	—	<0.001
Median	10.1	12.6		
Interquartile range	5.7–17.1	11.1–16.0		
Stress echocardiography	12.6±9.0	1.3±4.3	—	<0.001
Median	10.6	0.0		
Interquartile range	5.5–18.3	0.0–0.0		
Exercise electrocardiography	10.4±7.8	2.3±5.4	—	<0.001
Median	8.5	0.0		
Interquartile range	4.8–15.7	0.0–0.0		

Stress Testing Versus CT Angiography in Patients With Diabetes and Suspected Coronary Artery Disease

PROMISE Trial: PROspective Multicenter Imaging Study for Evaluation of Chest Pain

	Diabetes (n = 1,908)			No Diabetes (n = 7,058)		
	CTA (n = 936)	Functional (n = 972)	p Value	CTA (n = 3,564)	Functional (n = 3,494)	p Value
Physician characterization of chest pain						
Chest pain typicality			0.139			0.722
Typical	137/936 (14.6)	121/972 (12.4)		384/3,564 (10.8)	385/3,494 (11.0)	
Atypical	724/936 (77.4)	753/972 (77.5)		2,777/3,564 (77.9)	2,734/3,494 (78.2)	
Noncardiac	75/936 (8.0)	98/972 (10.1)		403/3,564 (11.3)	375/3,494 (10.7)	

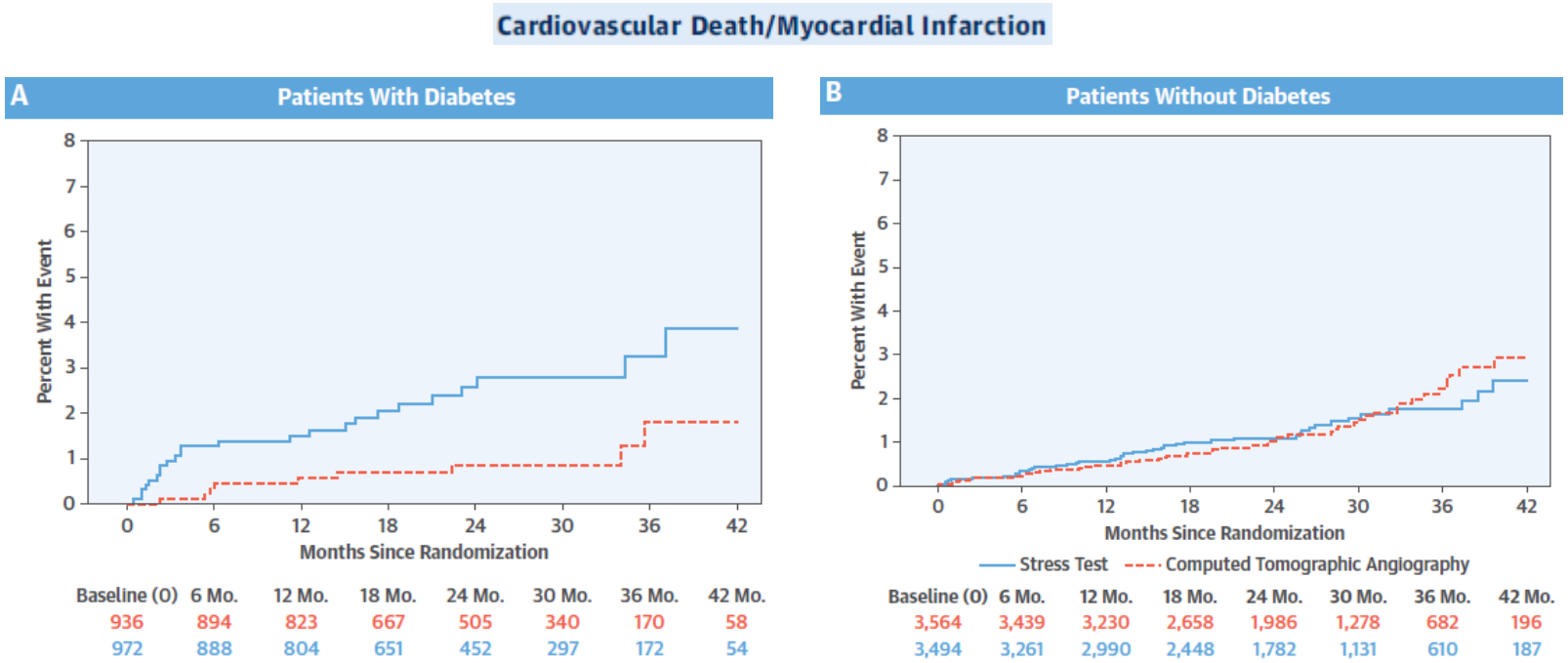
TABLE 3 Association Between Randomized Noninvasive Testing Modality and Clinical Outcomes by Diabetes History

	Raw Clinical Event Rate (No. of Events/Sample Size)		Unadjusted*		Adjusted†	
Clinical Endpoint	CTA	Stress Test	Hazard Ratio (95% CI)	p Value	Hazard Ratio (95% CI)	p Value
CV death/MI						
Interaction between diabetes and testing modality				0.022		0.020
CTA vs. stress test in patients with diabetes	10/936 (1.1)	25/972 (2.6)	0.39 (0.19-0.80)	0.011	0.38 (0.18-0.79)	0.010
CTA vs. stress test in patients without diabetes	50/3,564 (1.4)	45/3,494 (1.3)	1.03 (0.69-1.53)	0.901	1.03 (0.69-1.54)	0.887

Values are n/N (%) unless otherwise indicated. *Unadjusted model contains diabetes mellitus, initial noninvasive test modality, and their 2-way interaction. †Adjusted model controls for noninvasive test results (positive/negative), invasive coronary angiography results (positive/negative/not tested, time-dependent), revascularization (time-dependent), age (time-dependent), and sex.

Stress Testing Versus CT Angiography in Patients With Diabetes and Suspected Coronary Artery Disease

PROMISE Trial: PROspective Multicenter Imaging Study for Evaluation of Chest Pain

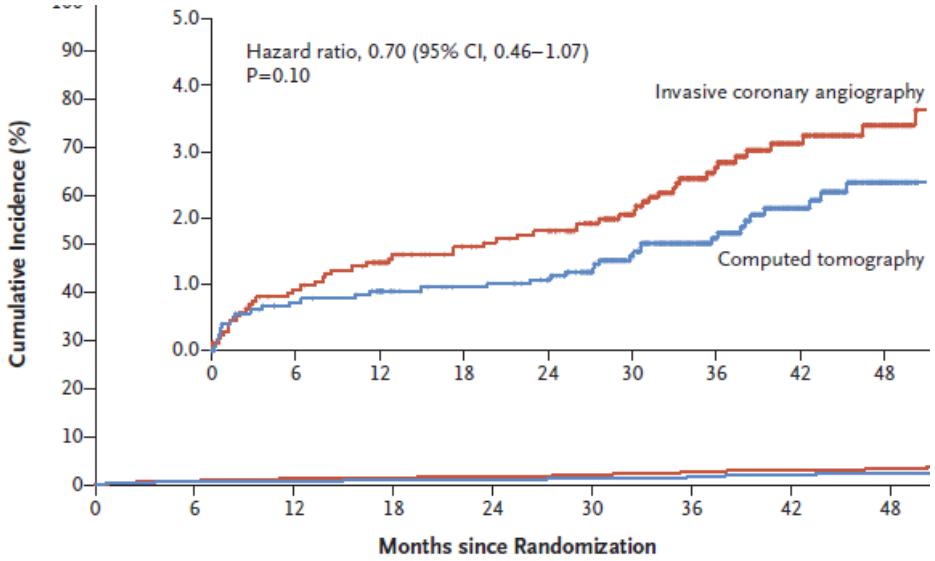


Sharma, A. et al. J Am Coll Cardiol. 2019;73(8):893-902.

CT or Invasive Coronary Angiography in Stable Chest Pain

The DISCHARGE Trial Group

Ά Καρδιολογική Κλινική ΑΧΕΠΑ



Outcome	Computed Tomography (N=1808)	Invasive Coronary Angiography (N=1753)	Effect Size (95% CI)†
Secondary outcomes			
Major procedure-related complications during initial management — no. (%)‡¶	9 (0.5)	33 (1.9)	0.26 (0.13 to 0.55)
ICA performed during initial management — no. (%)‖	404 (22.3)	1708 (97.4)	

NEJM 2022

Plaque volume, composition, and fraction versus ischemia and outcomes in patients with coronary artery disease

Jurrien H. Kuneman [a], Inge J. van den Hoogen [a], Jussi Schultz [b], Teemu Maaniitty [b], Alexander R. van Rosendael [a], Vasileios Kamperidis [a], Michiel A. de Graaf [a], Alexander Broersen [c], J. Wouter Jukema [a,d], Jeroen J. Bax [a,e], Antti Saraste [b,e], Juhani Knuuti [a,b,*]

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

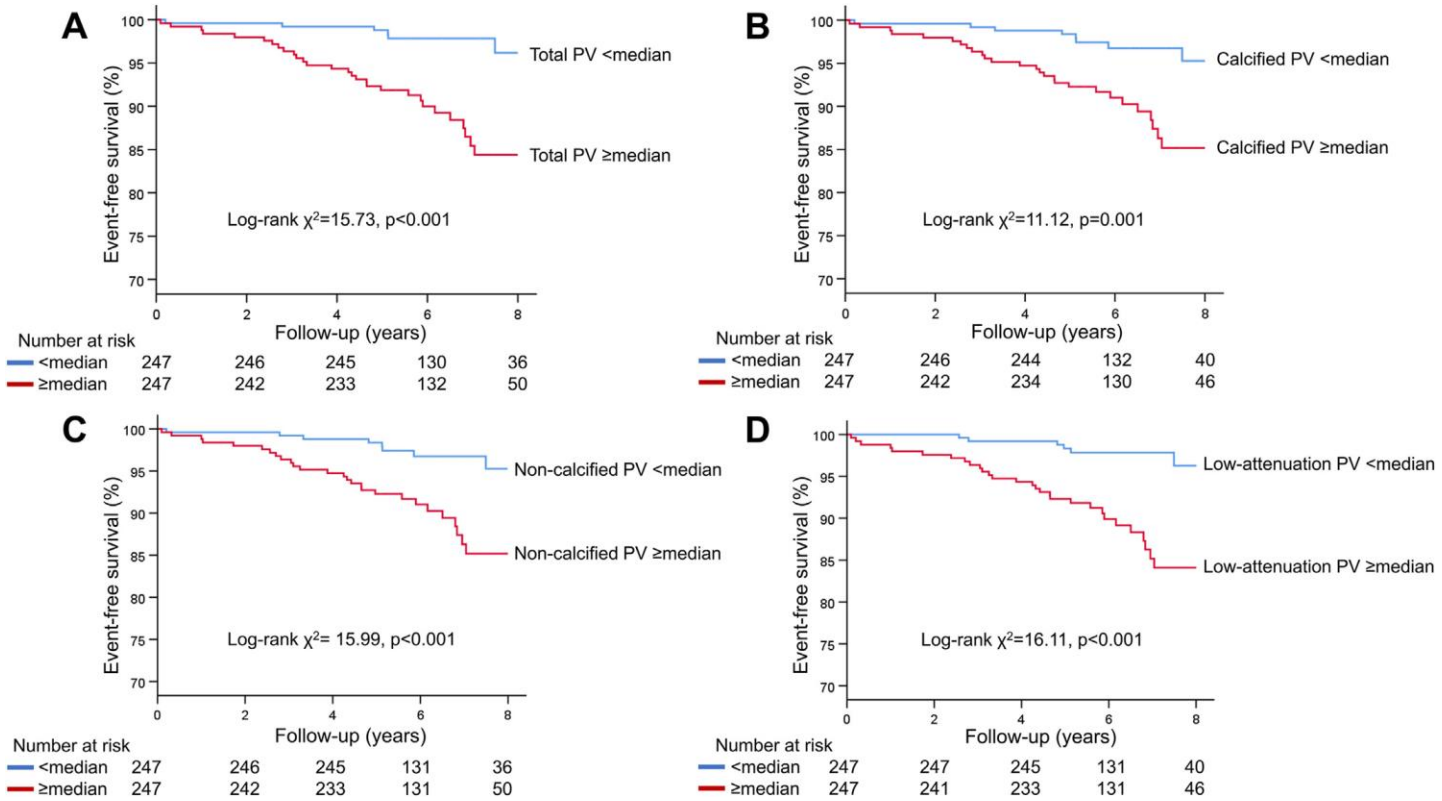


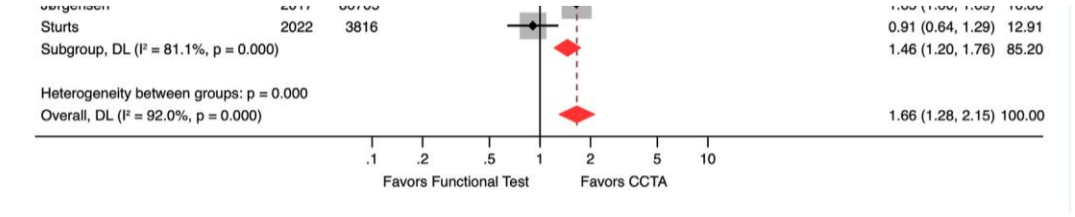
Fig. 3. PV of the various plaque components and risk of future adverse events. Kaplan-Meier curves demonstrating the event-free survival according to PV ≥ median (red curves) vs. <median (blue curves) for total PV (Panel A), calcified PV (Panel B), non-calcified PV (Panel C), and low-attenuation PV (Panel D). Clinical events included myocardial infarction or all-cause mortality. PV = plaque volume.

Changes in use of preventive medications after assessment of chest pain by coronary computed tomography angiography: A meta-analysis

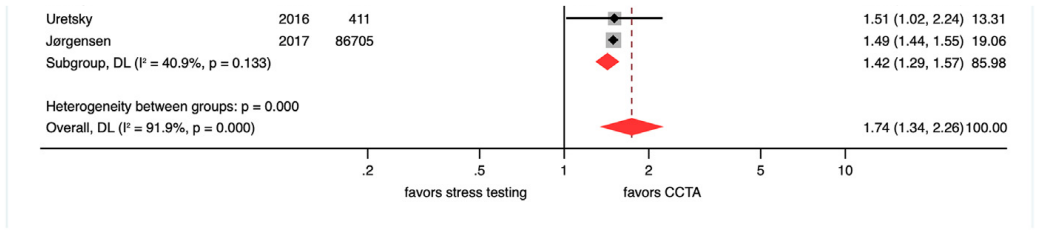
Giuliano Generoso [a], Vikram Agarwal [b], Leslee J. Shaw [c], Rhanderson Cardoso [b], Ron Blankstein [b], Marcio S. Bittencourt [d,*]

Check for updates

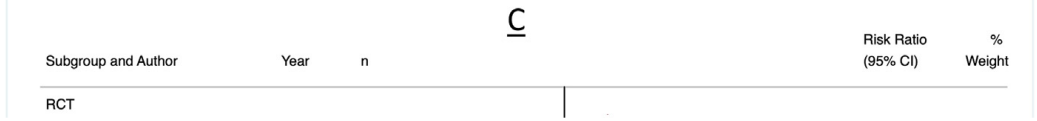
Ά Καρδιολογική Κλινική ΑΧΕΠΑ



STATIN



ASPIRIN

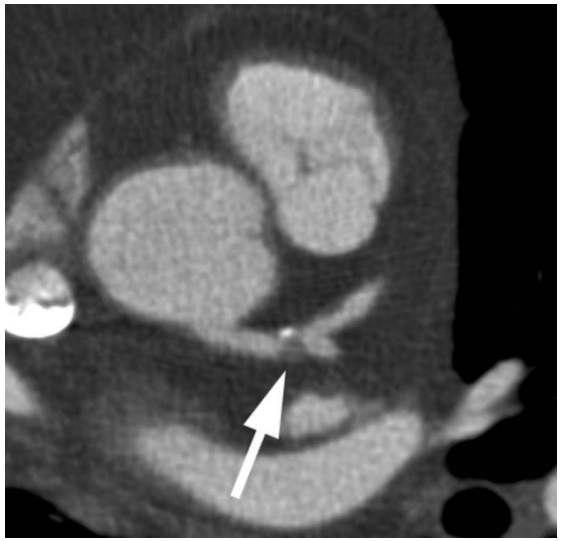


Silvia Smolka[1,2] · Milind Y. Desai[2] · Stephan Achenbach[1]

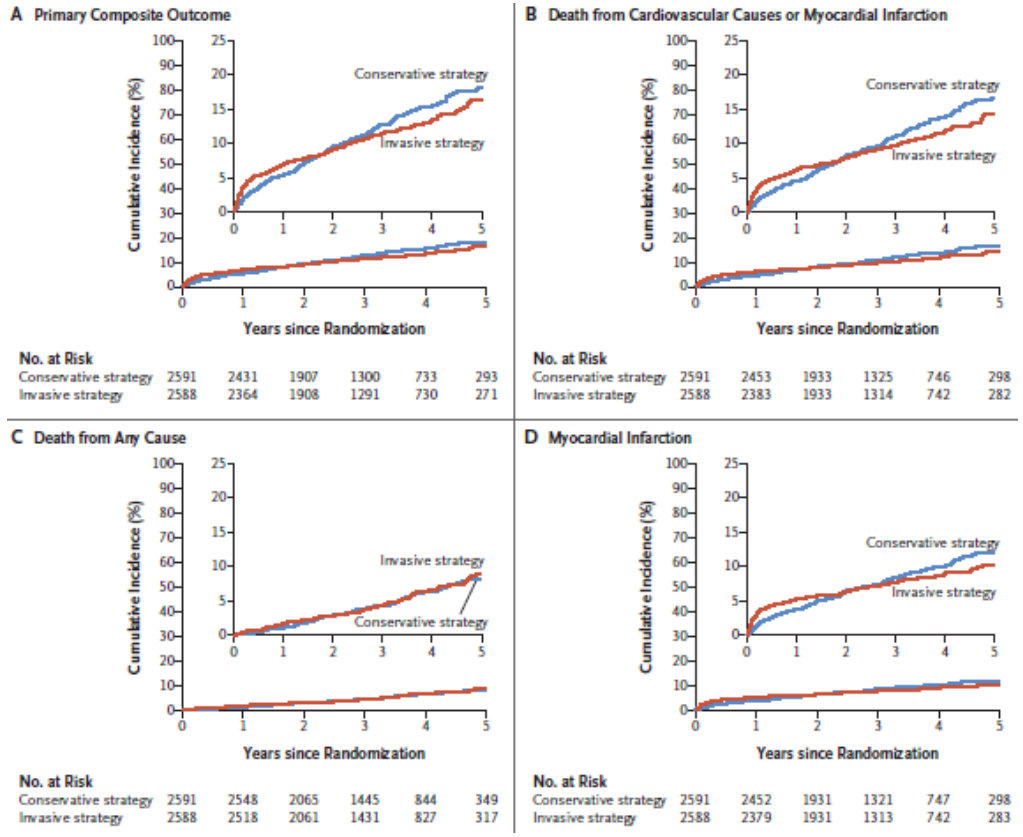
[1] Friedrich-Alexander-University Erlangen-Nürnberg (FAU), Department of Cardiology, University Hospital Erlangen, Erlangen, Germany

[2] Department of Cardiology, Heart and Vascular Institute, Cleveland Clinic, Cleveland, USA

After ISCHEMIA: Is coronary CTA the new gatekeeper?



LM in 5%

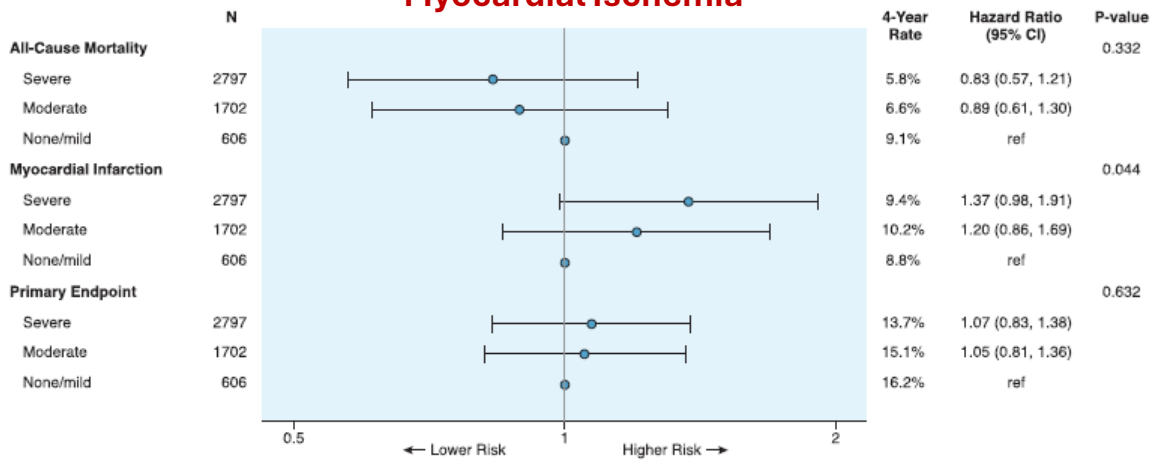


Maron. NEJM 2020

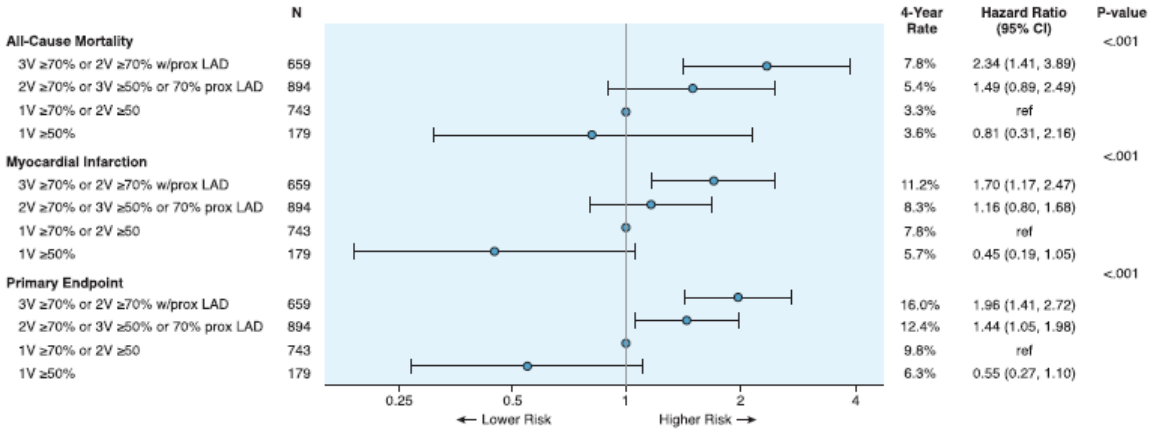
Outcomes in the ISCHEMIA Trial Based on Coronary Artery Disease and Ischemia Severity

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

Myocardial Ischemia



CCTA CAD Anatomy



Ischemia Trial

Post Hoc Analysis

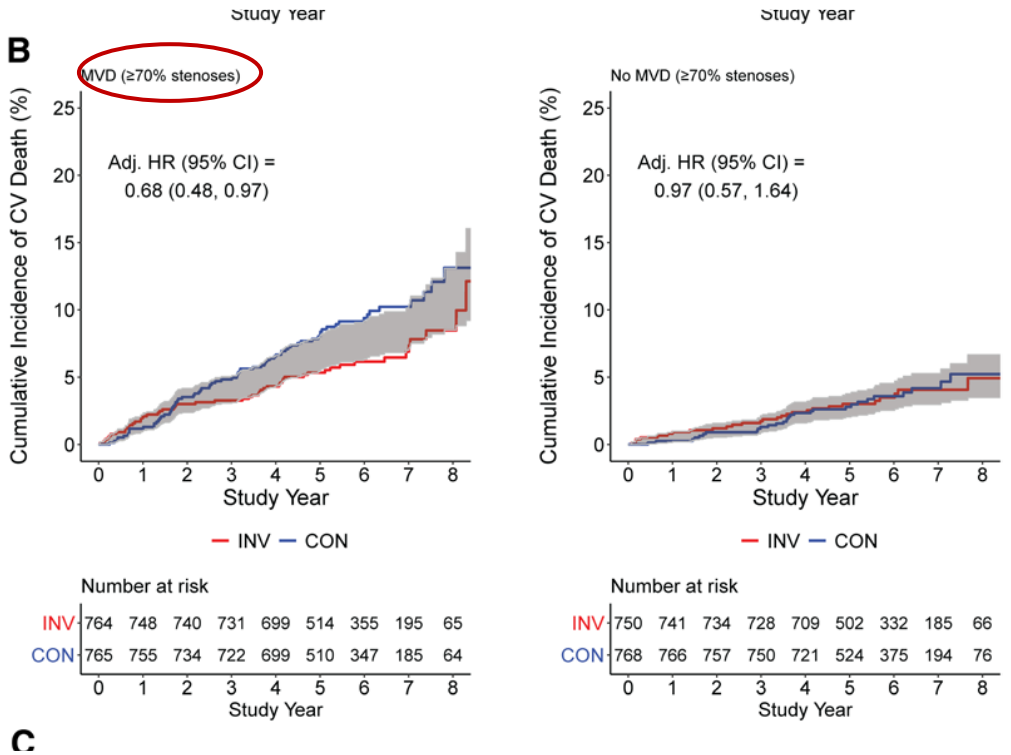
Survival After Invasive or Conservative Management of Stable Coronary Disease

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

ISCHEMIA-EXTEND Research Group*

According to CAD

CV mortality

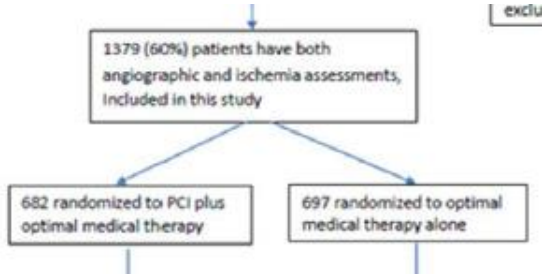


All cause mortality
Non-significant

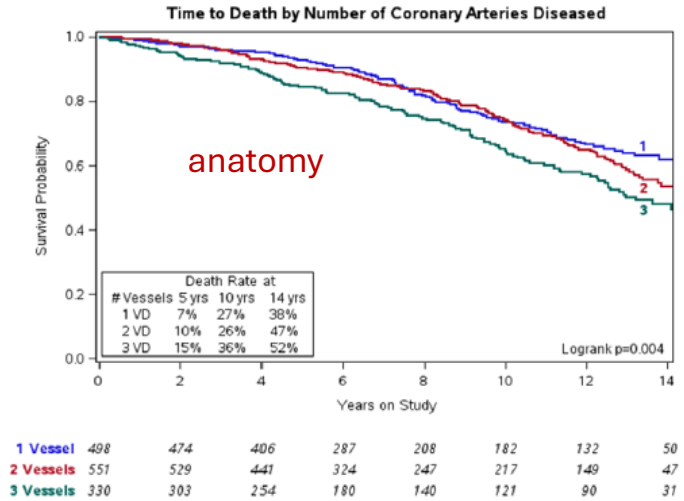
Non-CV mortality
Non-significant

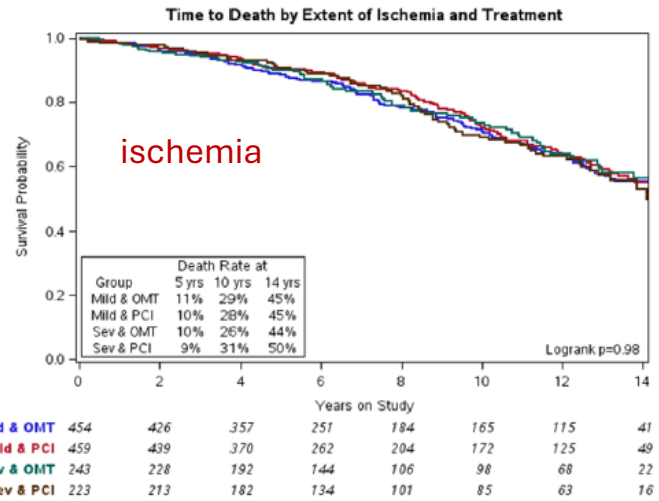
Effect of Coronary Anatomy and Myocardial Ischemia on Long-Term Survival in Patients with Stable Ischemic Heart Disease

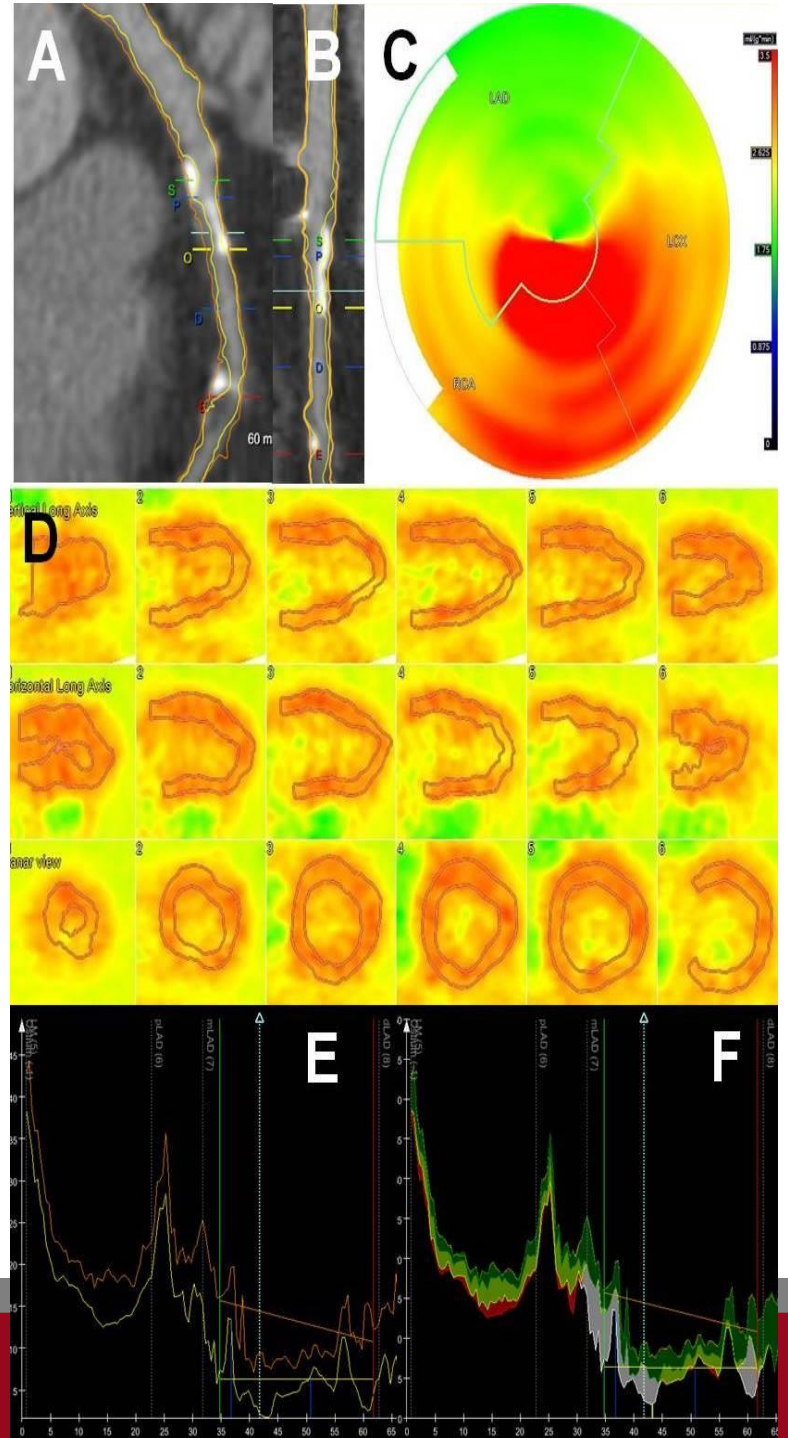
Ά Καρδιολογική Κλινική ΑΧΕΠΑ



COURAGE TRIAL







Atherosclerotic plaque characteristics on quantitative coronary computed tomography angiography associated with ischemia on positron emission tomography in diabetic patients

Vasileios Kamperidis MD, MSc, PhD[1,2], Michiel A. de Graaf MD, MSc, PhD[1], Valtteri Uusitalo MD[3], Victoria Delgado, MD, PhD[1], Antti Saraste MD, PhD[3,4], Arthur J. Scholte MD, PhD[1], Juhani Knuuti MD, PhD[3,4], Jeroen J. Bax MD, PhD[1]

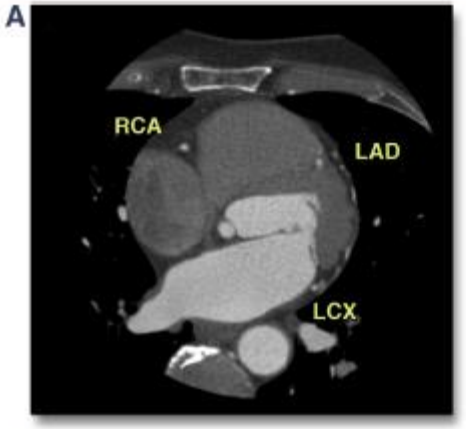
QCTA reveals all the characteristics of a plaque in the mid LAD (mLAD) that are associated with **ischemia**:

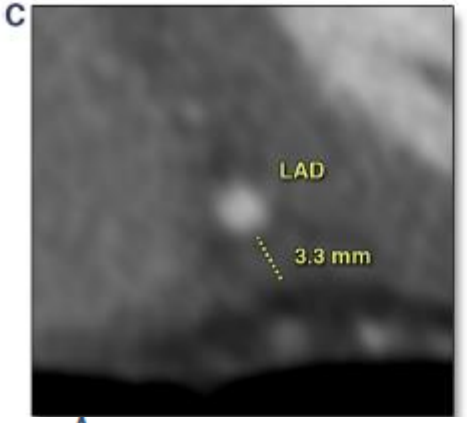
- lumen area stenosis 73%,
- lumen area 1.07mm^2,
- lesion length 14mm,
- mean plaque burden 78.39%,
- calcium volume 25mm^3

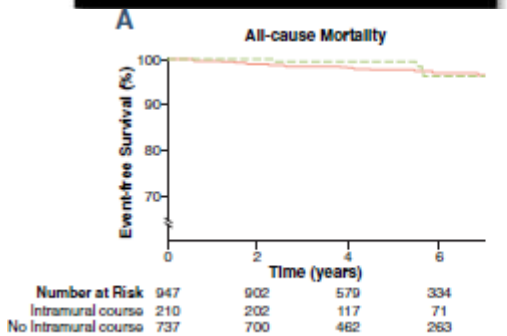
Myocardial Bridge

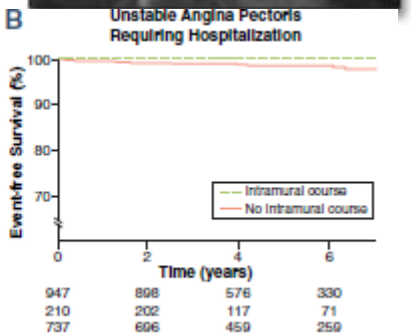
Ά Καρδιολογική Κλινική ΑΧΕΠΑ

FIGURE 1 Assessment of Intramural Course of Coronary Artery With Coronary Computed Tomography Angiography









RESEARCH ARTICLE Open Access

Ά Καρδιολογική Κλινική ΑΧΕΠΑ

Congenital coronary anomalies detected by coronary computed tomography compared to invasive coronary angiography

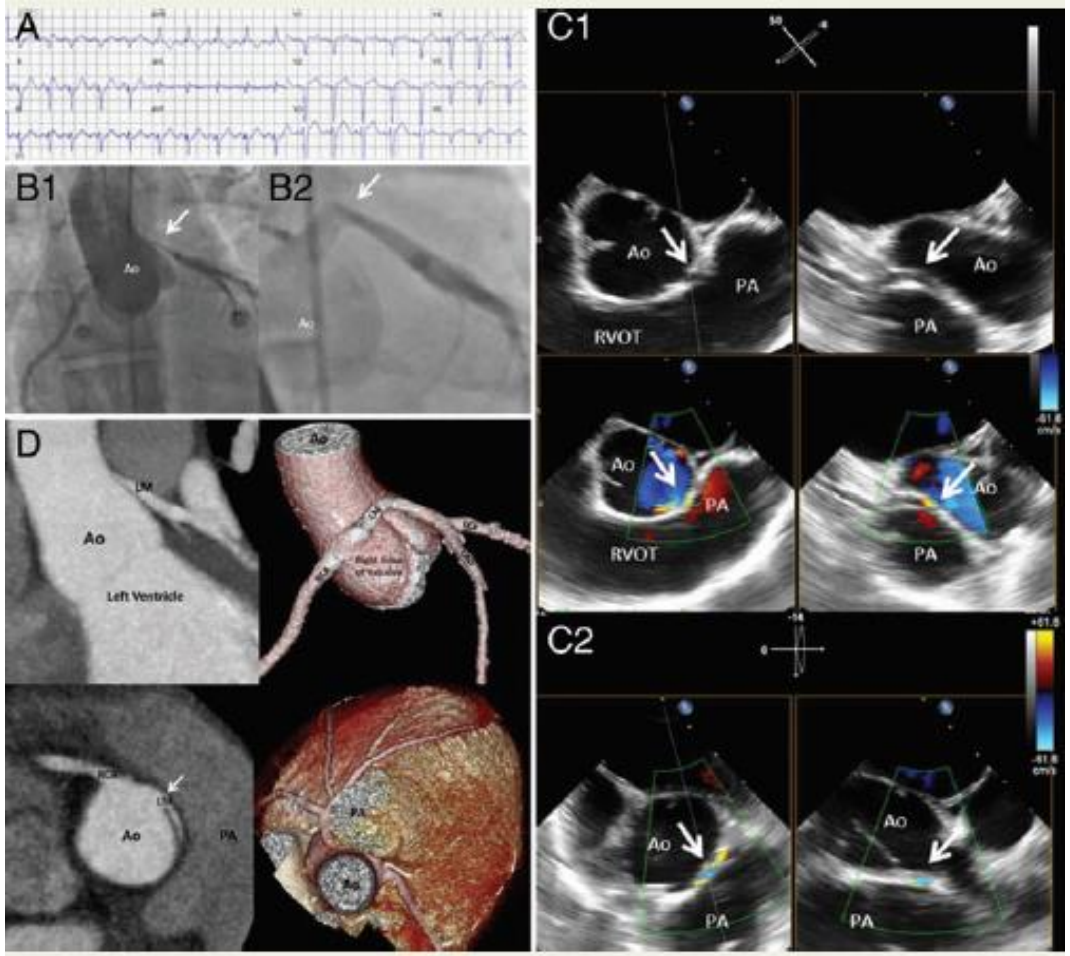
Table 1 Patient characteristics

	CCTA (n=1759)	ICA (n=9782)	*P*
Patients with coronary anomaly			
Total number	**138**	**203**	
Prevalence	7.85%	2.08%	<0.01

Three-dimensional transoesophageal echocardiographic visualization of malignant anomalous left main coronary origin and course causing sudden cardiac death

Vasileios Kamperidis[1]*, Spyridon Katsanos[1], Robin A. Bertels[2], Martin J. Schalij[1], and Victoria Delgado[1]

Ά Καρδιολογική Κλινική ΑΧΕΠΑ



ALCAPA syndrome and risk of sudden death in young people

V. Kamperidis[1], T.D. Karamitsos[1], Z. Pappa[1], O. Nikolaidou[2] and H. Karvounis[1]

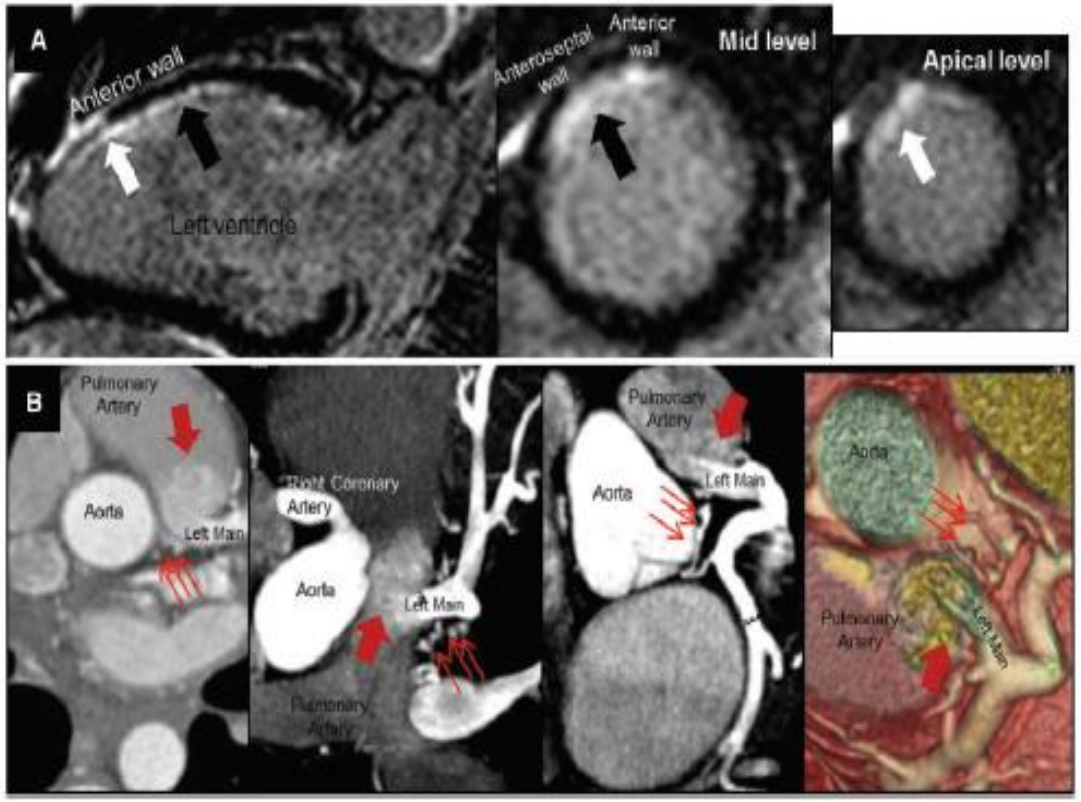
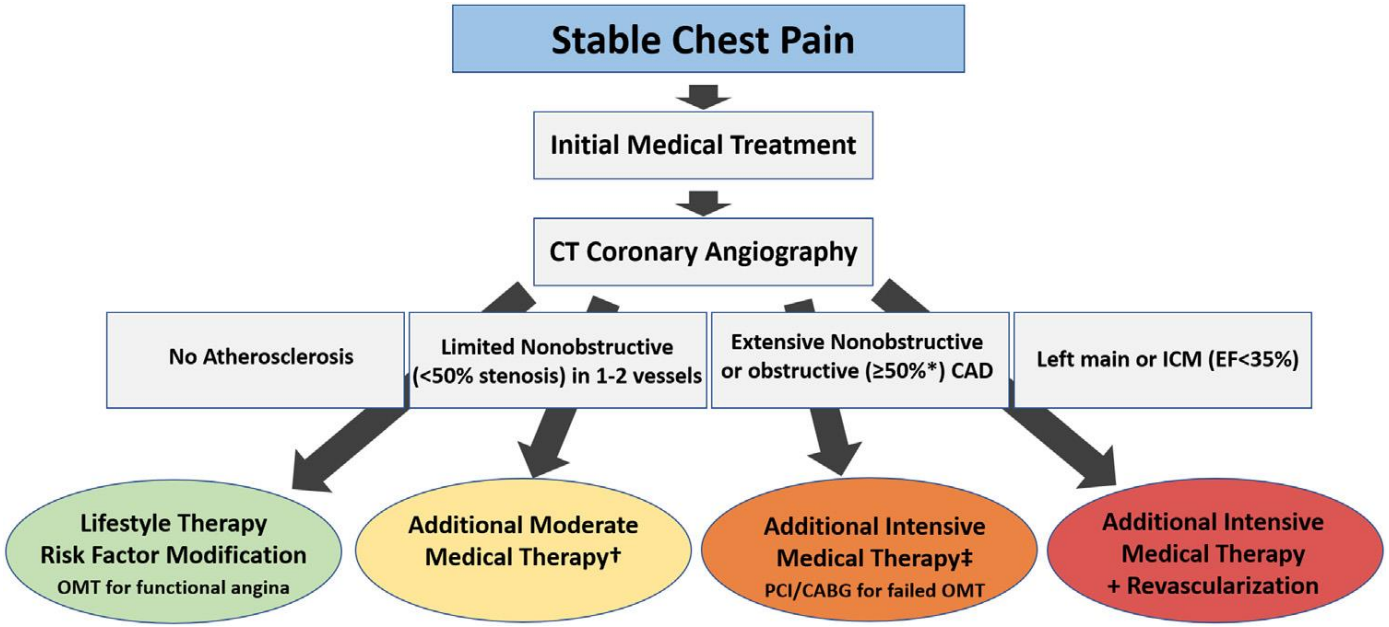


FIGURE 1 Contemporary Evaluation and Management of Stable Angina

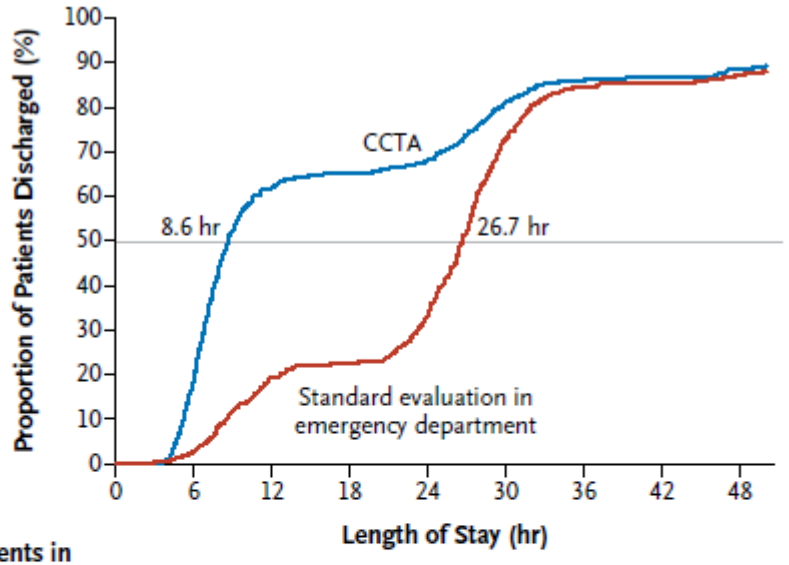


*Stenosis assessment by quantified analysis (corresponding to approximately 70% by visual evaluation) (29).†For example, single antiplatelet therapy, single-agent lipid-lowering therapy.‡For example, intensified antithrombotic and/or lipid-lowering therapy, anti-inflammatory treatment. Taken from Ferraro et al. J Am Coll Cardiol. 2020;76(19):2252-2266. CABG = coronary artery bypass grafting; CAD = coronary artery disease; CT = computed tomography; ICM = ischemic cardiomyopathy; OMT = optimal medical therapy; PCI = percutaneous coronary intervention.

CCTA

Σε ασθενείς με οξύ προκάρδιο άλγος

Coronary CT Angiography versus Standard Evaluation in Acute Chest Pain



No. of Patients in Emergency Department or Hospital									
CCTA	501	404	191	174	159	95	70	66	57
Standard evaluation	499	484	403	387	331	135	77	72	63

Figure 2. Length of Stay in the Hospital and Proportion of Patients Discharged.

The cumulative frequency of discharge from the index visit according to the length of stay is shown. The horizontal line indicates the median length of stay in the two study groups, which was significantly different (8.6 hours in the CCTA group vs. 26.7 hours in the standard-evaluation group, P<0.001).

N=1000

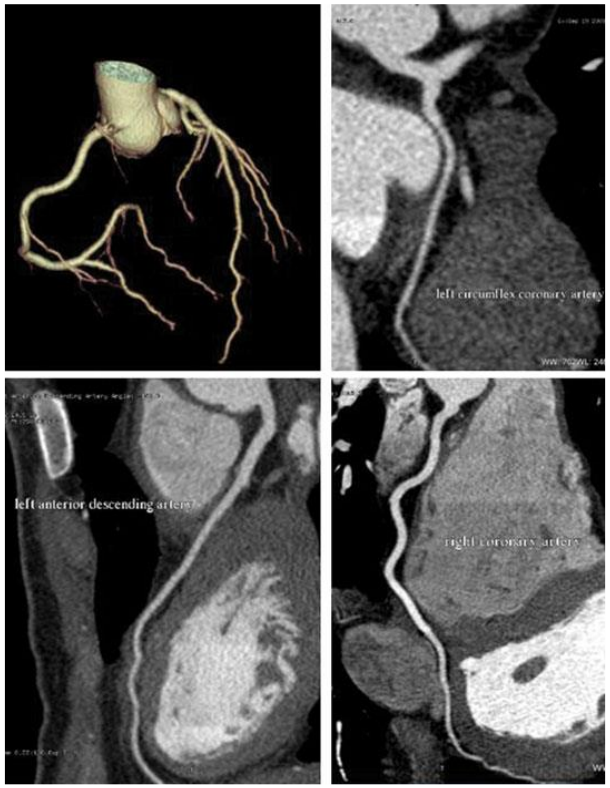
NEJM 2012

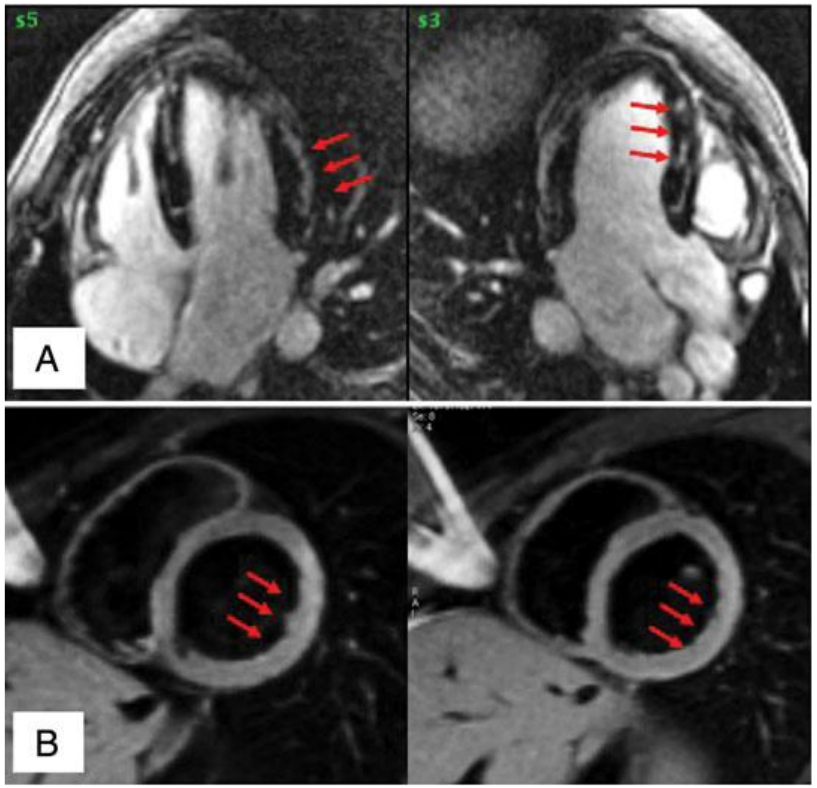
CCTA to exclude ACS in the A&E

Author/Study	Journal/Year	Inclusion criteria	Population	Endpoint	Follow-up	Major findings
U. Hoffmann et al/ ROMICAT	JACC/2009	Acute chest pain with normal initial troponin and non-ischaemic ECG	368	ACS during hospitalisation; MACE during follow-up	6 months	A negative CCTA has a 100% negative predictive value for ACS both during hospitalisation and at follow-up
C.L. Schlett/ ROMICAT	JACC Img/2011	Acute chest pain with normal initial troponin and non-ischaemic ECG	368	ACS during hospitalisation; MACE during follow-up	2 years	A negative CCTA has a 100% negative predictive value for ACS both during hospitalisation and at follow-up
J.A. Goldstein et/ CT-STAT	JACC/2011	Unstable angina/NSTEMI with normal or non-diagnostic rest ECG and TIMI risk score <4	699	Primary: time to diagnoses. Secondary: 1) Cost of care during hospitalisation; 2) MACE	6 months	CCTA results in more rapid and cost-efficient safe diagnosis than rest-stress MP
U. Hoffmann et al/ ROMICAT II	NEJM/2012	Acute chest pain with normal initial troponin and non-ischaemic ECG	1,000	Primary: Length of the hospital stay. Secondary: 1) rates of discharge from the ED; 2) MACE at 28 days; 3) cumulative costs; 4) ACS	28 days	CCTA improved clinical decision efficiency, but it resulted in an increase in downstream testing and radiation exposure with no decrease in the overall costs
H.I. Litt et al/ ACRIN-PA	NEJM/2012	Acute chest pain non-ischaemic ECG and TIMI <2	1,370	Primary: MACE. Secondary: time to discharge	30 days	CCTA allows safe discharge (no MACE among those with negative CCTA) reducing time to discharge
A. Dedic et al/ BEACON	JACC/2016	Acute coronary syndrome without need of urgent revascularisation and hs-Tn-I <3 ULN	500	Primary : revascularisation within 30 days. Secondary: length of hospital stay, undetected ACS, radiation exposure, medical costs and repeat visits to the ED	30 days	CCTA early in the work-up of suspected ACS is safe and associated with less outpatient testing and lower costs. However, with hs-troponins, CCTA does not identify more patients with significant CAD

Figure 3. *CCTA in the emergency department. Findings of multicentre studies on the use of CCTA in patients with suspected acute coronary syndrome. CCTA: coronary CT angiography*

Acute coronary syndrome or myocarditis? The role of multimodality imaging

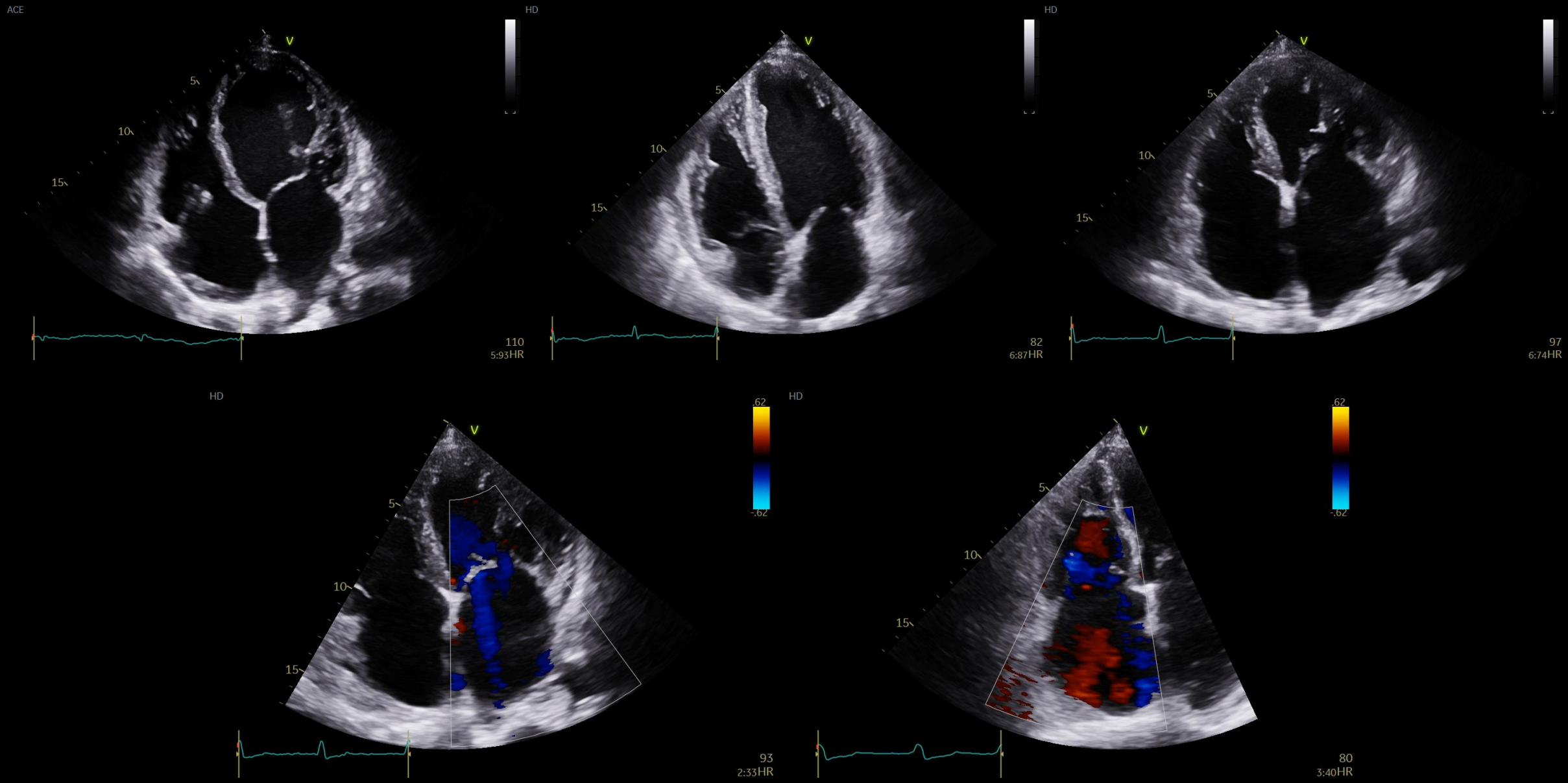




CCTA

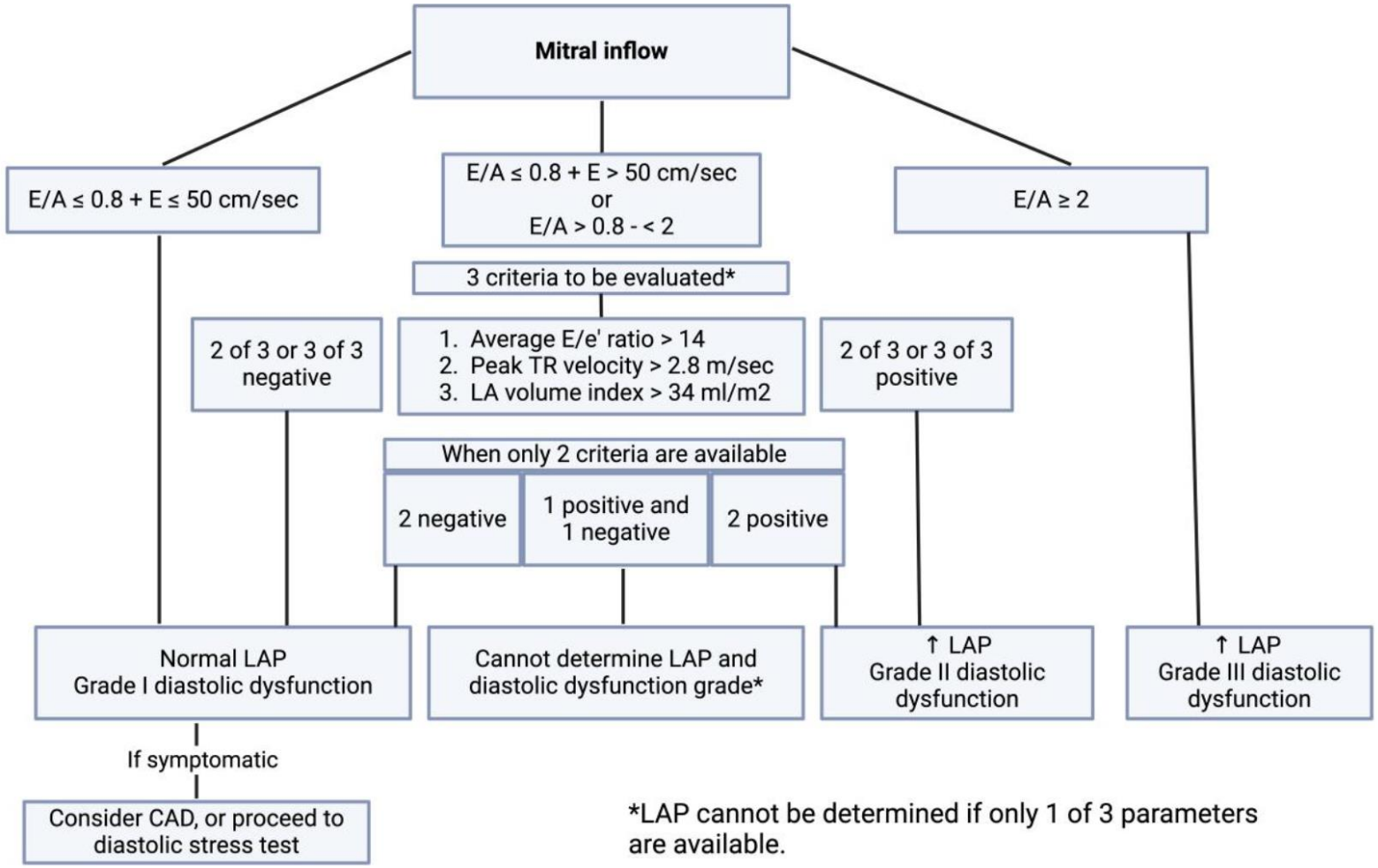
Σε ασθενείς με οξεία καρδιακή ανεπάρκεια

HF Phenotypes



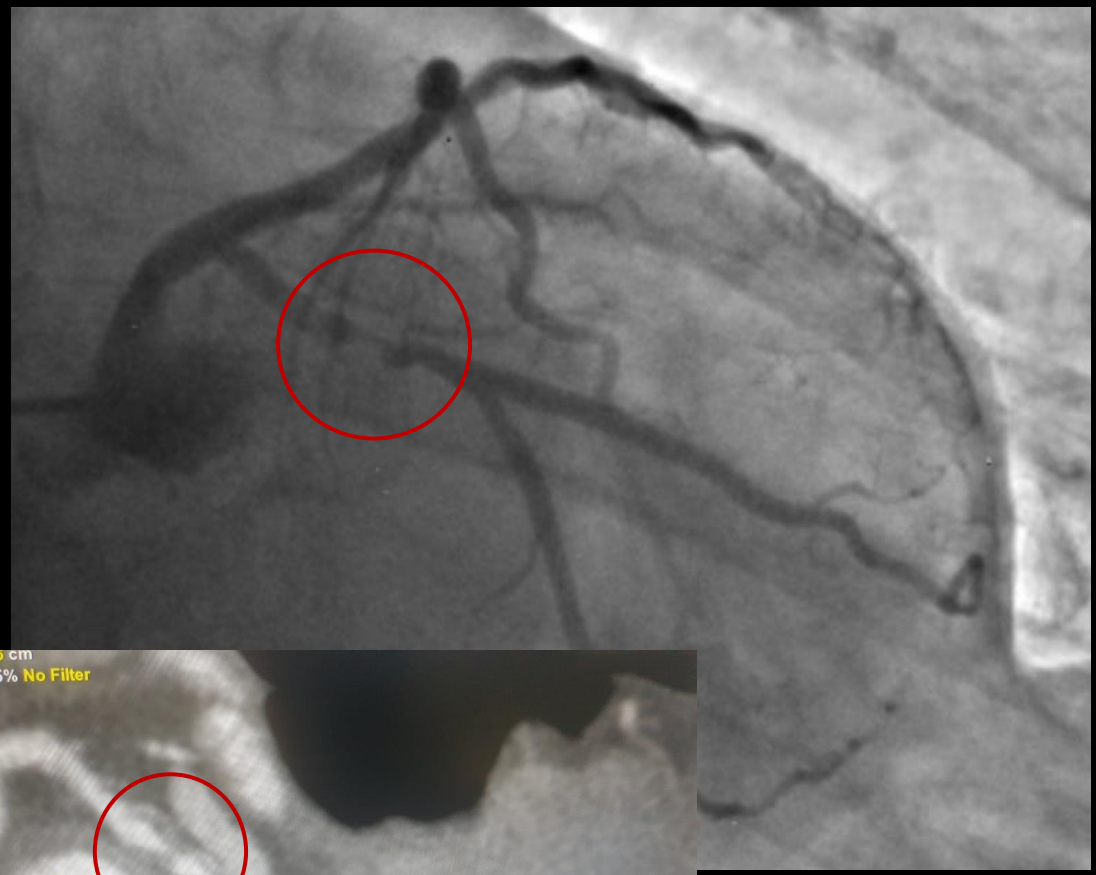
Changes in recommendations

2021	Class	2016	Class
Recommendations for diagnosis of HF			
Invasive coronary angiography may be considered in patients with HFrEF with an intermediate to high pre-test probability of CAD and the presence of ischaemia in non-invasive stress tests.	**IIb**	Invasive coronary angiography should be considered in patients with HF and intermediate to high pre-test probability of CAD and the presence of ischaemia in non-invasive stress tests (who are considered suitable for potential coronary revascularization) in order to establish the diagnosis of CAD and its severity.	**IIa**
CTCA should be considered in patients with a low to intermediate pre-test probability of CAD or those with equivocal non-invasive stress tests in order to rule out coronary artery stenosis.	**IIa**	Cardiac CT may be considered in patients with HF and low to intermediate pre-test probability of CAD or those with equivocal non-invasive stress tests in order to rule out coronary artery stenosis.	**IIb**



*LAP cannot be determined if only 1 of 3 parameters are available.


75%
mm/rot
52sp
PRS
ALI
Dmin=2.6 mm
Dmean=2.7 mm
Area=5.7 mm2
IRP
SLA
PLANOUDIS STERGIOS
GENIKI KLINIKI
M 81 4193
Ex:May 28 2019
0 L 103LAO37 CAU
0.49/ XSection
kV 120
mAMod.
Rot 0.35s/CH 8.8mm/rot
0.6mm 0.22:10.62sp
Tilt: 0.0
03:40:28 PM
W =1200 L =240
Oblique
Ex:4193
Se:133
Left Marginal Branch LP: 46.8
DFOV:4.4cm
STND/C2 No Filter Ph:75%
BPM:62

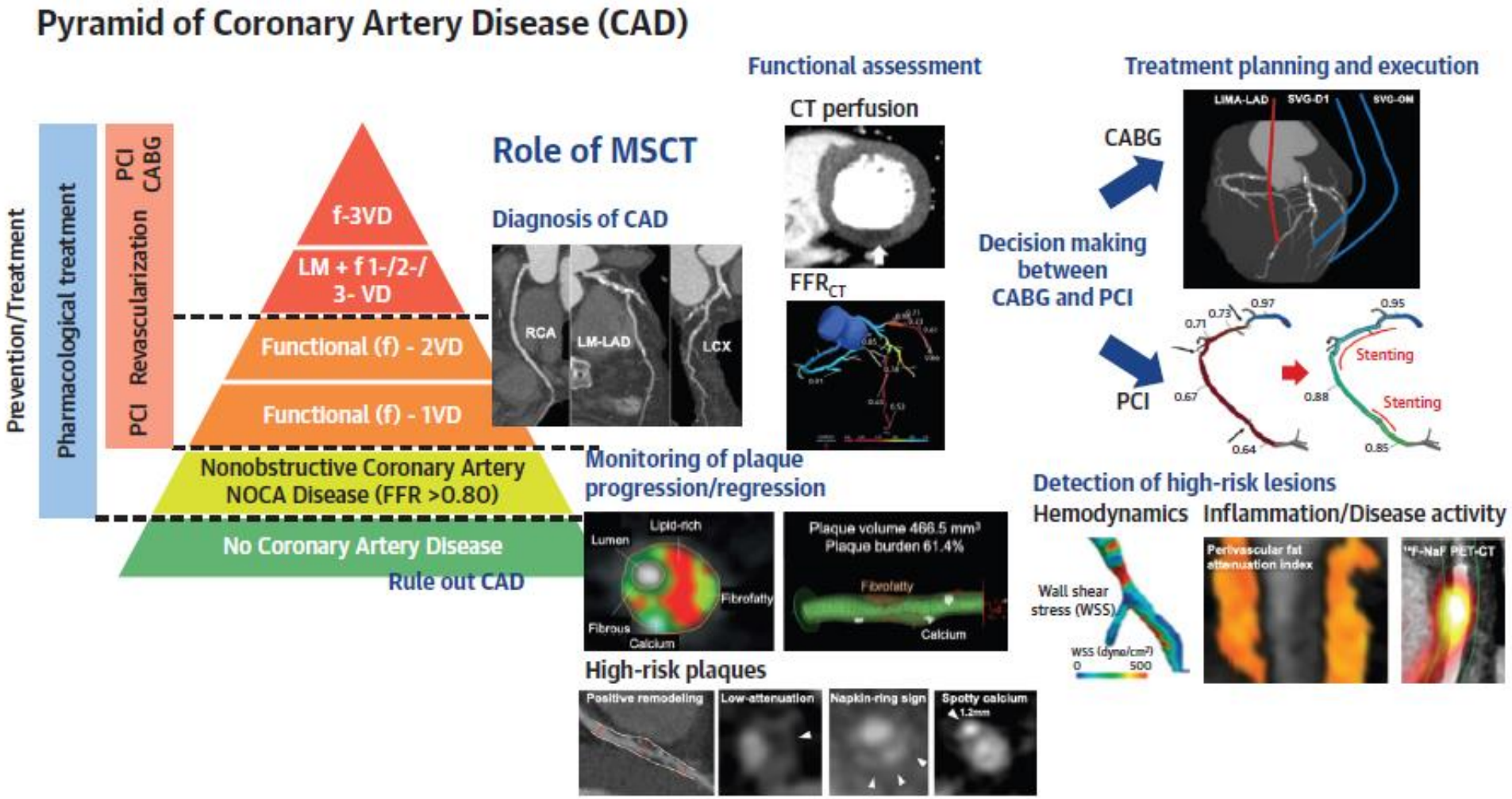



Ph:75% No Filter
LCx

Supplementary Table 1. Anatomical diagnostic performance of CCTA with ICA as a standard reference.

Study/Author	Reference standard (ICA)	Year	Number of Patients	Sensitivity	Specificity	PPV	NPV	+LR	-LR	Accuracy
ACCURACY (Budoff MJ et al.)	≥50%	2008	230	95	83	64	99	5.56	0.06	NA
Meijboom WB et al.	≥50%	2008	360	99	64	86	97	2.76	0.01	88
MINISCAD (Marano R et al.)	>50%	2009	327	94	88	91	91	7.83	0.07	91
CORE-64 (Arbab-Zadeh A et al.)	≥50%	2012	273	91	87	9	88	7.00	0.10	NA
EVINCI (Neglia D et al.)	>70%, 30-70% with FFR ≤0.80, or LM >50%	2015	475	91	92	83	96	11.38	0.10	91
Budoff MJ et al.	>50%	2017	77	85	90	81	92	8.50	0.17	NA
PICTURE (Budoff MJ et al.)	≥50%	2017	230	92	78	82	90	4.18	0.10	NA
Andreini D et al.: Patients with atrial fibrillation	>50%	2017	83	95	98	95	98	39.00	0.05	96
Andreini D et al.: Patients with heart rate ≥80bpm	>50%	2018	40	100	82	100	82	5.56	0	90
Motoyama S et al.: UHR-CT, Median CACS 171	≥75%	2018	59	100	80	94	100	5.00	0	NA
Takagi H et al.: UHR-CT, Median CACS 250	≥50%	2018	38 Vessels: 113	100 96	67 81	94 80	100 96	3.00 4.96	0 0.05	95 88
VERDICT: NSTEACS (Linde JJ et al.)	≥50%	2020	1,023	97	72	91	88	3.49	0.05	89
Latina J et al. [15]: UHR-CT, Median CACS 1205	≥70%	2021	15 Vessels: 86	100 86	100 88	100 70	100 95	- 7.17	0 0.16	NA NA
CREDENCE: AI-QCT (Griffin WF et al.[19])	≥50% ≥70%	2022	303	94 94	68 82	81 69	90 97	2.94 5.22	0.09 0.07	84 86

CONCLUSION



Serruys, P.W. et al. J Am Coll Cardiol. 2021;78(7):713-736.

CONCLUSION

JACC: CARDIOVASCULAR IMAGING
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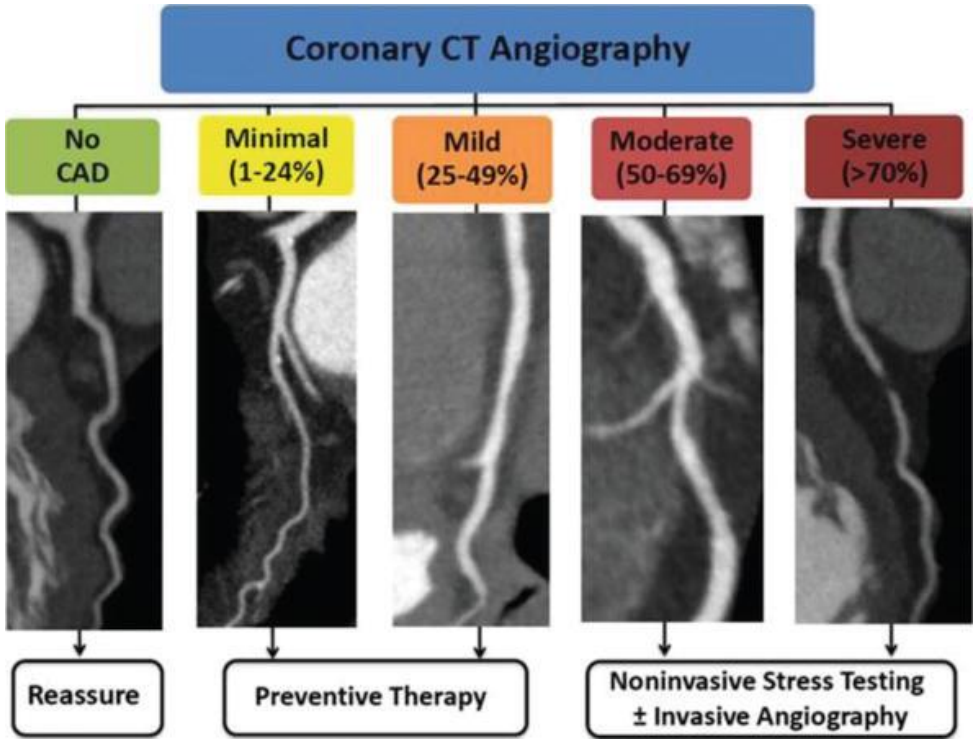
EDITORIAL COMMENT

Is a Picture Worth a Thousand Guidelines?*

Michael K. Cheezum, MD,[a] Nishant R. Shah, MD, MPH, MSc[b]

For many patients, seeing this picture and individualizing preventive therapy may be worth a thousand guidelines.



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