Détection de la maladie athéromateuse coronaire chez le diabétique

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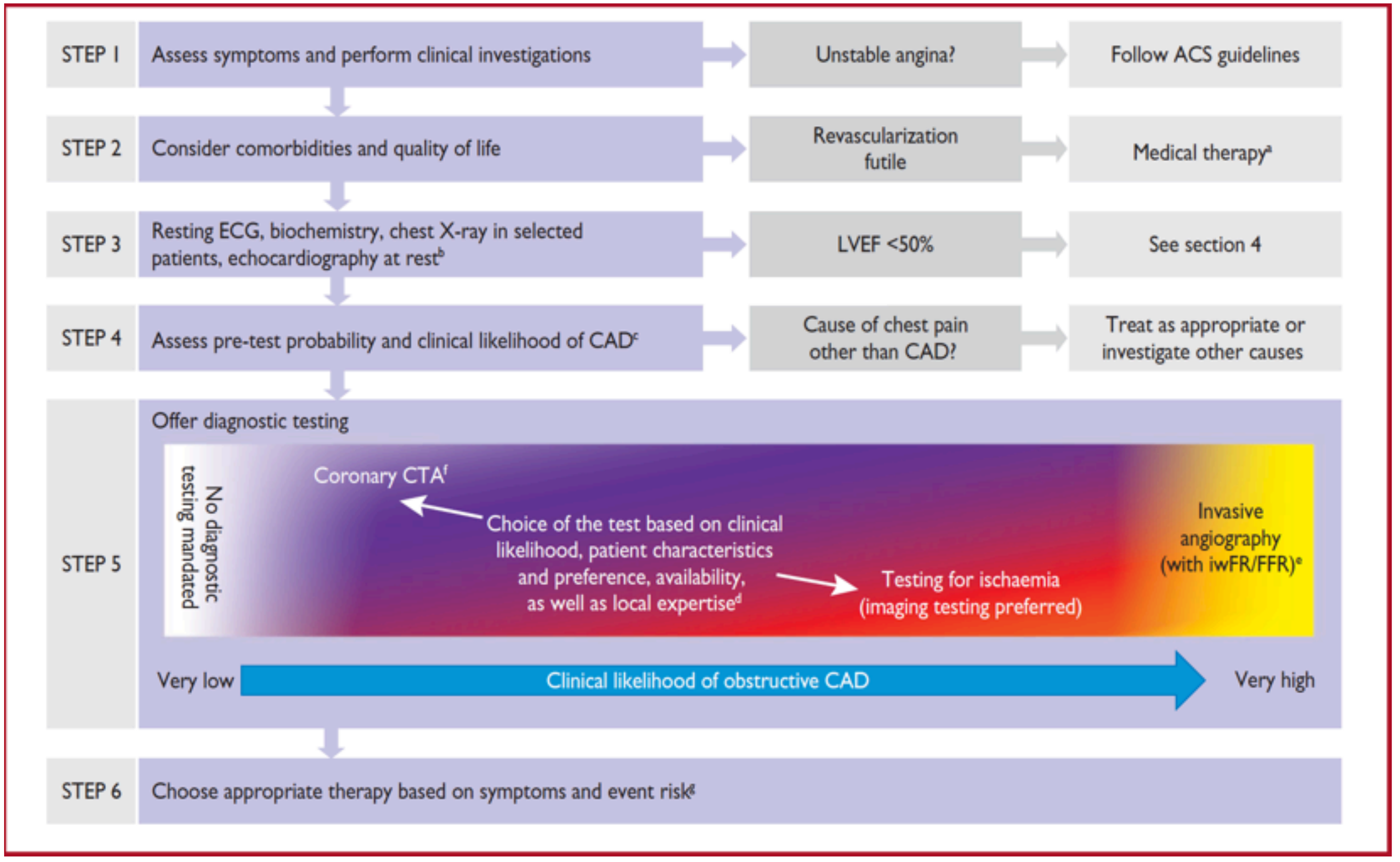
Diabète et coronaropathie

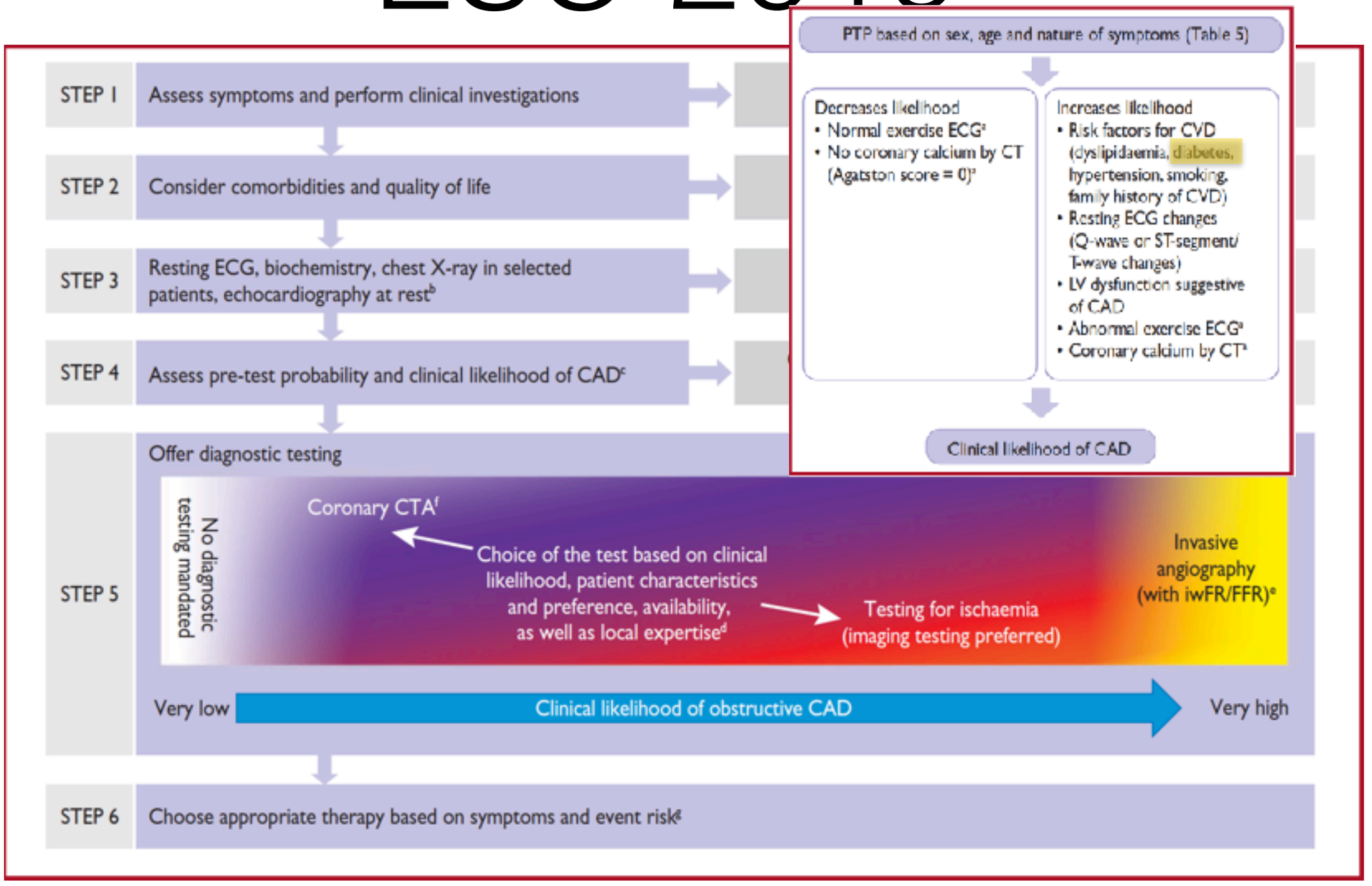
- 2 fois plus de risque d'événements chez les hommes
- 4 fois plus chez les femmes
- Facteur de mauvais pronostic de la maladie coronaire
- Importance d'une détection précoce

Patients symptomatiques

ESC 2019


STEP 1
Assess symptoms and perform clinical investigations
Unstable angina?
Follow ACS guidelines
STEP 2
Consider comorbidities and quality of life
Revascularization futile
Medical therapy[a]
STEP 3
Resting ECG, biochemistry, chest X-ray in selected patients, echocardiography at rest[b]
LVEF <50%
See section 4
STEP 4
Assess pre-test probability and clinical likelihood of CAD[c]
Cause of chest pain other than CAD?
Treat as appropriate or investigate other causes
STEP 5
Offer diagnostic testing
No diagnostic testing mandated
Coronary CTA[f]
Choice of the test based on clinical likelihood, patient characteristics and preference, availability, as well as local expertise[d]
Testing for ischaemia (imaging testing preferred)
Invasive angiography (with iwFR/FFR)[e]
Very low
Clinical likelihood of obstructive CAD
Very high
STEP 6
Choose appropriate therapy based on symptoms and event risk[g]

ESC 2019


STEP 1
Assess symptoms and perform clinical investigations
STEP 2
Consider comorbidities and quality of life
STEP 3
Resting ECG, biochemistry, chest X-ray in selected patients, echocardiography at rest[b]
STEP 4
Assess pre-test probability and clinical likelihood of CAD[c]
PTP based on sex, age and nature of symptoms (Table 5)
Decreases likelihood
• Normal exercise ECG[a]
• No coronary calcium by CT (Agatston score = 0)[a]
Increases likelihood
• Risk factors for CVD (dyslipidaemia, diabetes, hypertension, smoking, family history of CVD)
• Resting ECG changes (Q-wave or ST-segment/T-wave changes)
• LV dysfunction suggestive of CAD
• Abnormal exercise ECG[a]
• Coronary calcium by CT[a]
Clinical likelihood of CAD
STEP 5
Offer diagnostic testing
No diagnostic testing mandated
Coronary CTA[f]
Choice of the test based on clinical likelihood, patient characteristics and preference, availability, as well as local expertise[d]
Testing for ischaemia (imaging testing preferred)
Invasive angiography (with iwFR/FFR)[e]
Very low
Clinical likelihood of obstructive CAD
Very high
STEP 6
Choose appropriate therapy based on symptoms and event risk[g]

Evolution des recommandations

Changes in major recommendations			
2013	**Class[a]**	**2019**	**Class[a]**
Exercise ECG is recommendedas the initial test to establish a diagnosis of stable CAD in patients withsymptoms of angina and intermediate PTP of CAD (15–65%), free of anti-ischaemic drugs, unless they cannot exercise or display ECG changes that make the ECG non-evaluable.	I	Exercise ECG is recommended for the assessment of exercise tolerance, symptoms, arrhythmias, BP response, and event risk in selected patients.	I
		Exercise ECG may be considered as an alternative test to rule-in or rule-out CAD when other non-invasive or invasive imaging methods are not available.	IIb
Exercise ECG should be considered in patients on treatment to evaluate control of symptoms and ischaemia.	IIa	Exercise ECG may be considered in patients on treatment to evaluate control of symptoms and ischaemia.	IIb

Patients asymptomatiques

Intérêt du dépistage?

patient plus souvent asymptomatique

ESC European Society of Cardiology

European Heart Journal - Cardiovascular Imaging (2018) **19**, 838–846
doi:10.1093/ehjci/jey014

REVIEW

Non-invasive screening for coronary artery disease in asymptomatic diabetic patients: a systematic review and meta-analysis of randomised controlled trials

**Olivier F. Clerc, Tobias A. Fuchs, Julia Stehli, Dominik C. B
Michael Messerli, Andreas A. Giannopoulos, Ronny R. Bue
Aju P. Pazhenkottil, Philipp A. Kaufmann, and Oliver Gaer**

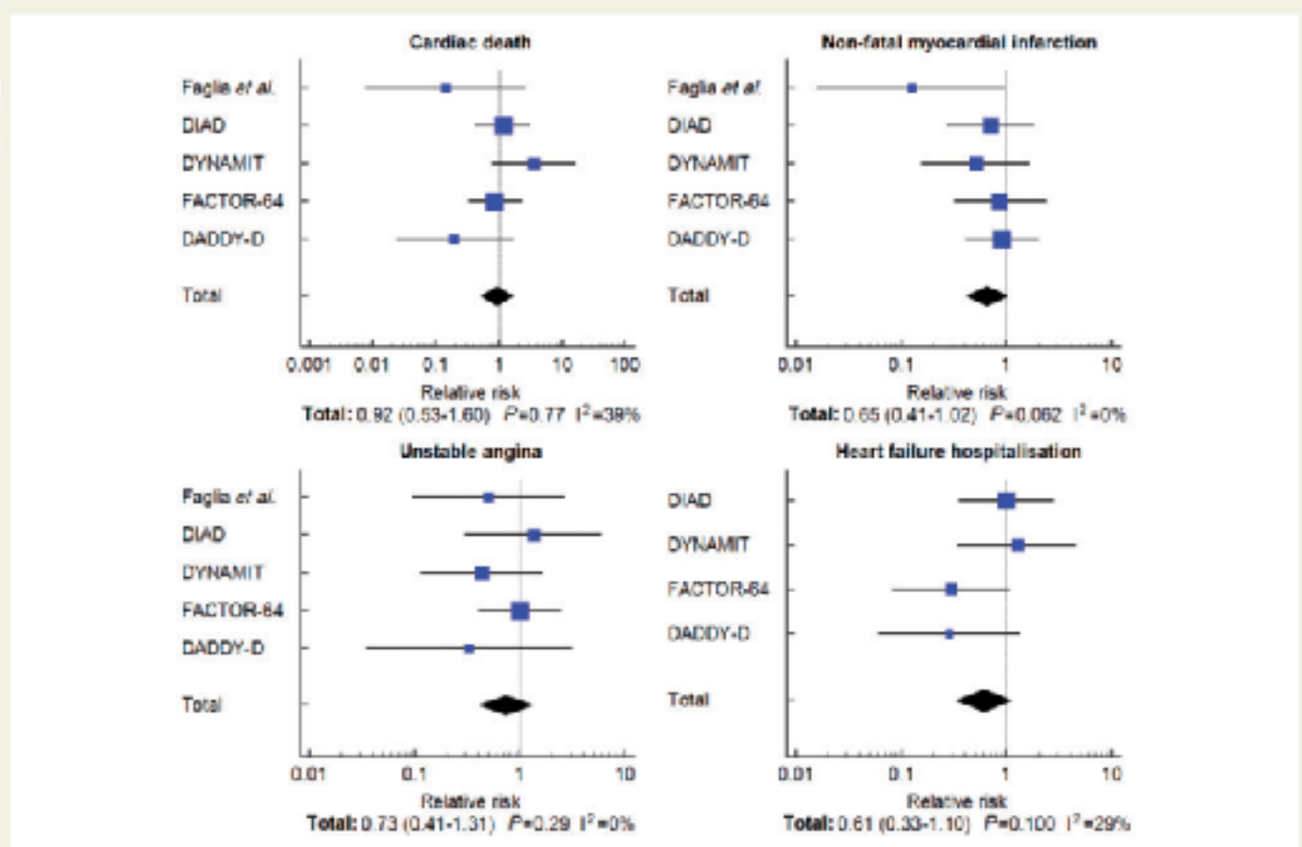


Figure 3 Meta-analysis of components of the primary endpoint.

Stratification du risque

- Hétérogénéité de la population diabétique non prise en compte

- SCORE non valable pour les patients diabétiques

- Nécessité d'un score dédié, prise en compte de FDR spécifique au diabète (durée de la maladie, équilibre glycémique, microangiopathie…)

Stratification du risque

2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD

Table 7 Cardiovascular risk categories in patients with diabetes[a]

Very high risk	Patients with DM **and** established CVD **or** other target organ damage[b] **or** three or more major risk factors[c] **or** early onset T1DM of long duration (>20 years)
High risk	Patients with DM duration >10 years without target organ damage plus any other additional risk factor
Moderate risk	Young patients (T1DM aged <35 years or T2DM aged <50 years) with DM duration <10 years, without other risk factors

CV = cardiovascular; CVD = cardiovascular disease; DM = diabetes mellitus; T1DM = type 1 diabetes mellitus; T2DM = type 2 diabetes mellitus.

[a]Modified from the 2016 European Guidelines on cardiovascular disease prevention in clinical practice.[27]

[b]Proteinuria, renal impairment defined as eGFR <30 mL/min/1.73 m^2, left ventricular hypertrophy, or retinopathy.

[c]Age, hypertension, dyslipidemia, smoking, obesity.

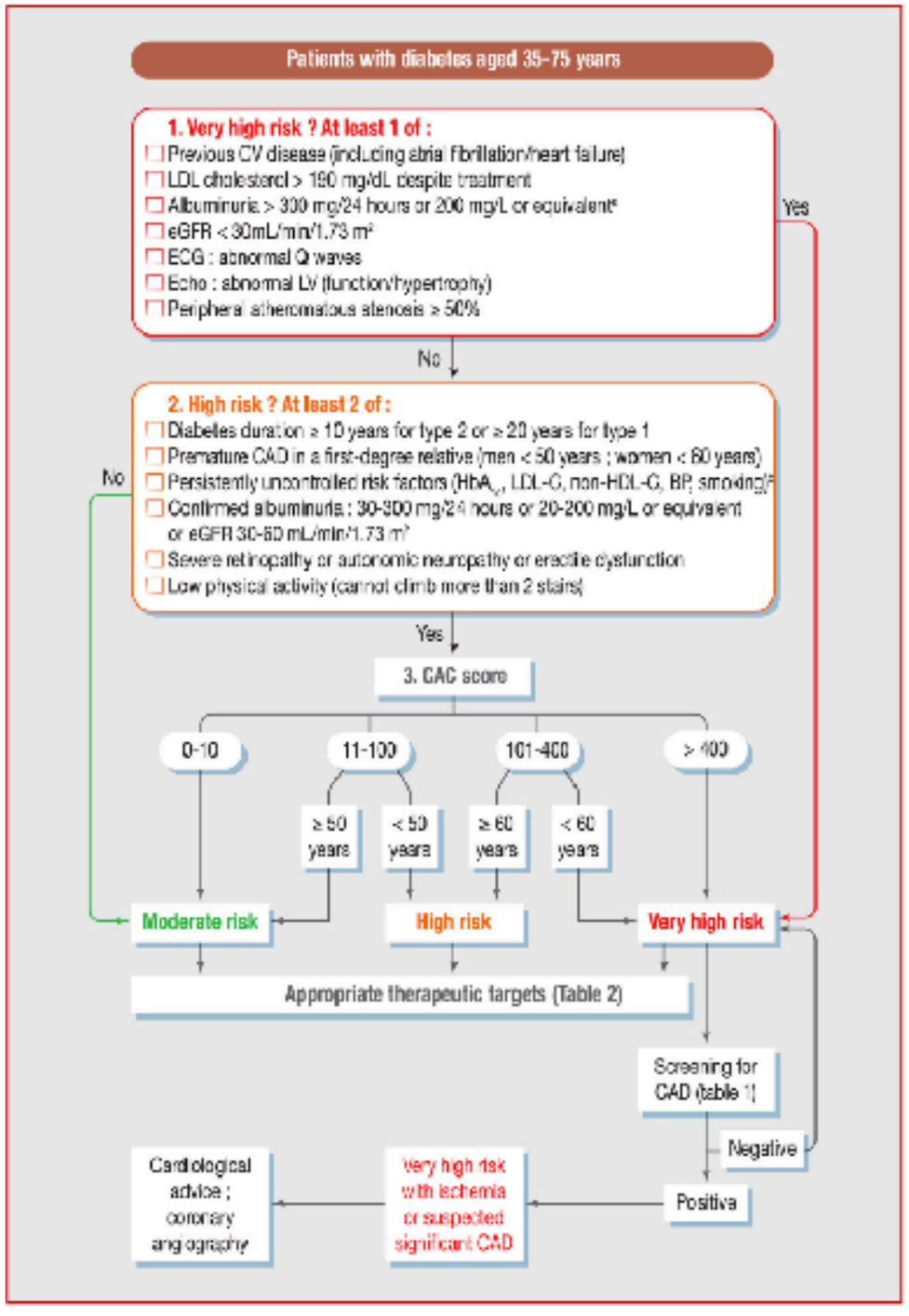
ESC 2019

Recommendations for the use of laboratory, electrocardiogram, and imaging testing for cardiovascular risk assessment in asymptomatic patients with diabetes

Recommendations	Class[a]	Level[b]
Routine assessment of microalbuminuria is indicated to identify patients at risk of developing renal dysfunction or at high risk of future CVD.[27,38]	I	B
A resting ECG is indicated in patients with DM diagnosed with hypertension or with suspected CVD.[38,39]	I	C
Assessment of carotid and/or femoral plaque burden with arterial ultrasonography should be considered as a risk modifier in asymptomatic patients with DM.[60–62]	IIa	B
CAC score with CT may be considered as a risk modifier in the CV risk assessment of asymptomatic patients with DM at moderate risk.[c] [63]	IIb	B
CTCA or functional imaging (radionuclide myocardial perfusion imaging, stress cardiac magnetic resonance imaging, or exercise or pharmacological stress echocardiography) may be considered in asymptomatic patients with DM for screening of CAD.[47,48,64,65,67–70]	IIb	B
ABI may be considered as a risk modifier in CV risk assessment.[76]	IIb	B
Detection of atherosclerotic plaque of carotid or femoral arteries by CT, or magnetic resonance imaging, may be considered as a risk modifier in patients with DM at moderate or high risk CV.[c] [75,77]	IIb	B
Carotid ultrasound intima–media thickness screening for CV risk assessment is not recommended.[62,73,78]	III	A
Routine assessment of circulating biomarkers is not recommended for CV risk stratification.[27,31,35–37]	III	B
Risk scores developed for the general population are not recommended for CV risk assessment in patients with DM.	III	C

ABI = ankle–brachial index; CAC = coronary artery calcium; CAD = coronary artery disease; CT = computed tomography; CTCA = computed tomography coronary angiography; CV = cardiovascular; CVD = cardiovascular disease; DM = diabetes mellitus; ECG = electrocardiogram.

SFC/SFD 2021



réévaluation du risque ts les ans
dépistage CAD 3-5 chez très haut risque restant asymptomatique

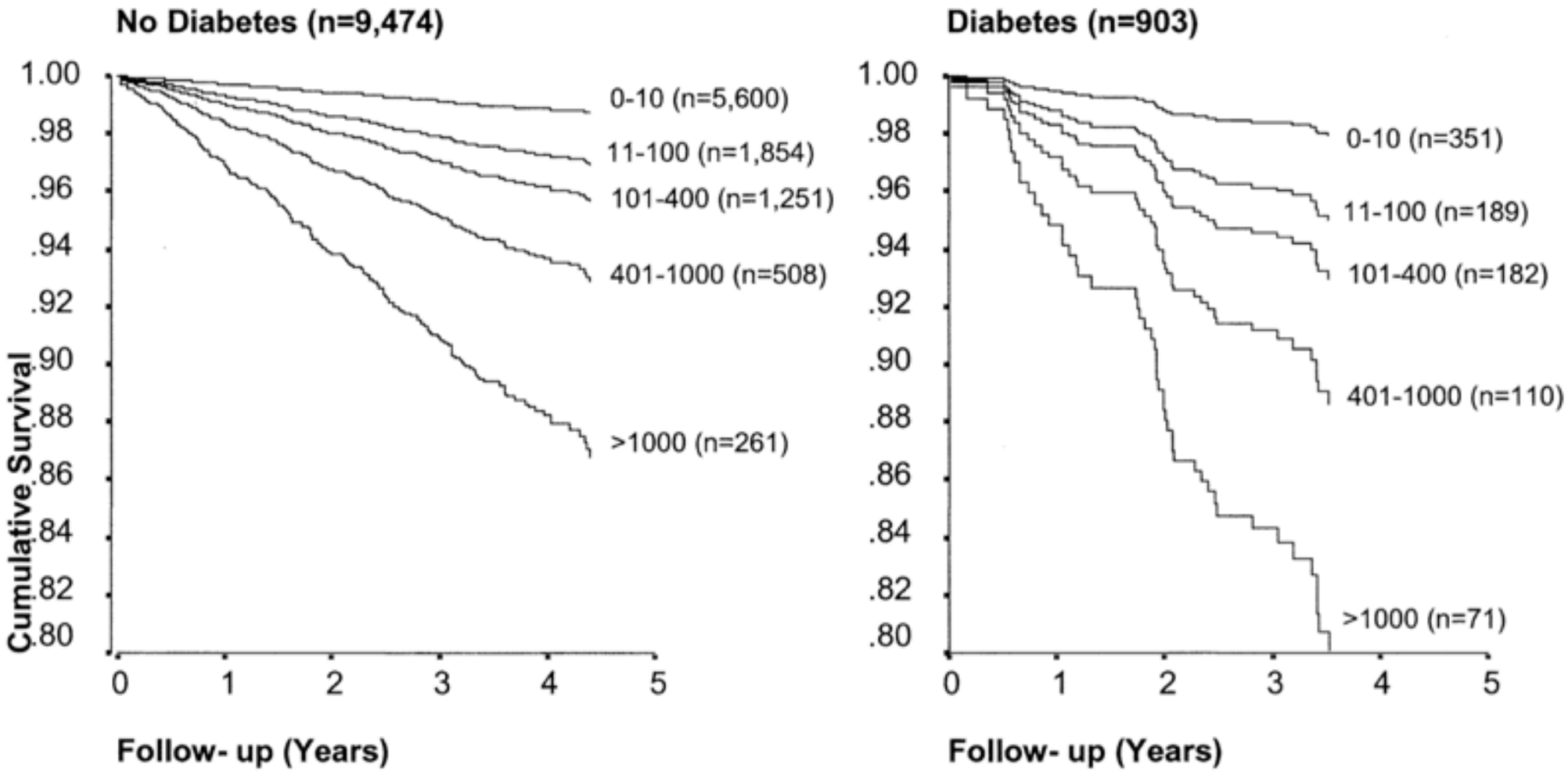
Score calcique

- Examen simple et reproductible
- Peu irradiant (<1mS)
- Sans injection de produit de contraste
- Quantification des calcifications coronaires
- Score Agatston (1990): > 130 UH

Score calcique

Raggi *et al.*
Value of Coronary Calcium Screening

JACC Vol. 43, No. 9, 2004
May 5, 2004:1663–9



Score calcique

Raggi *et al.*
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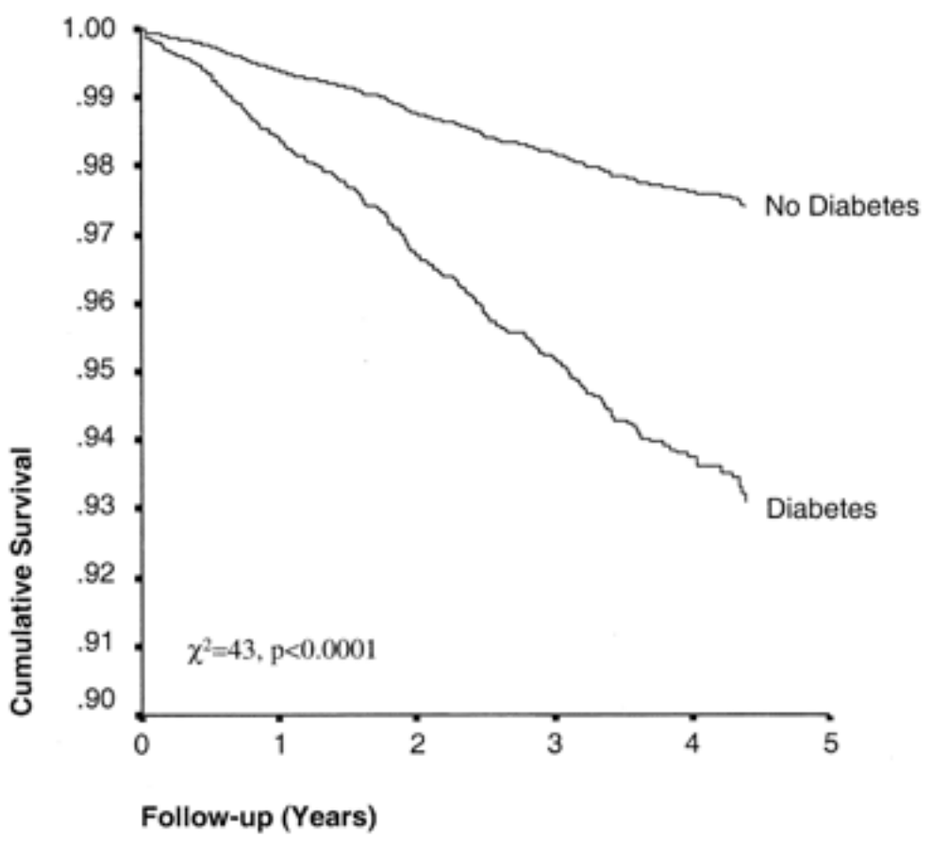
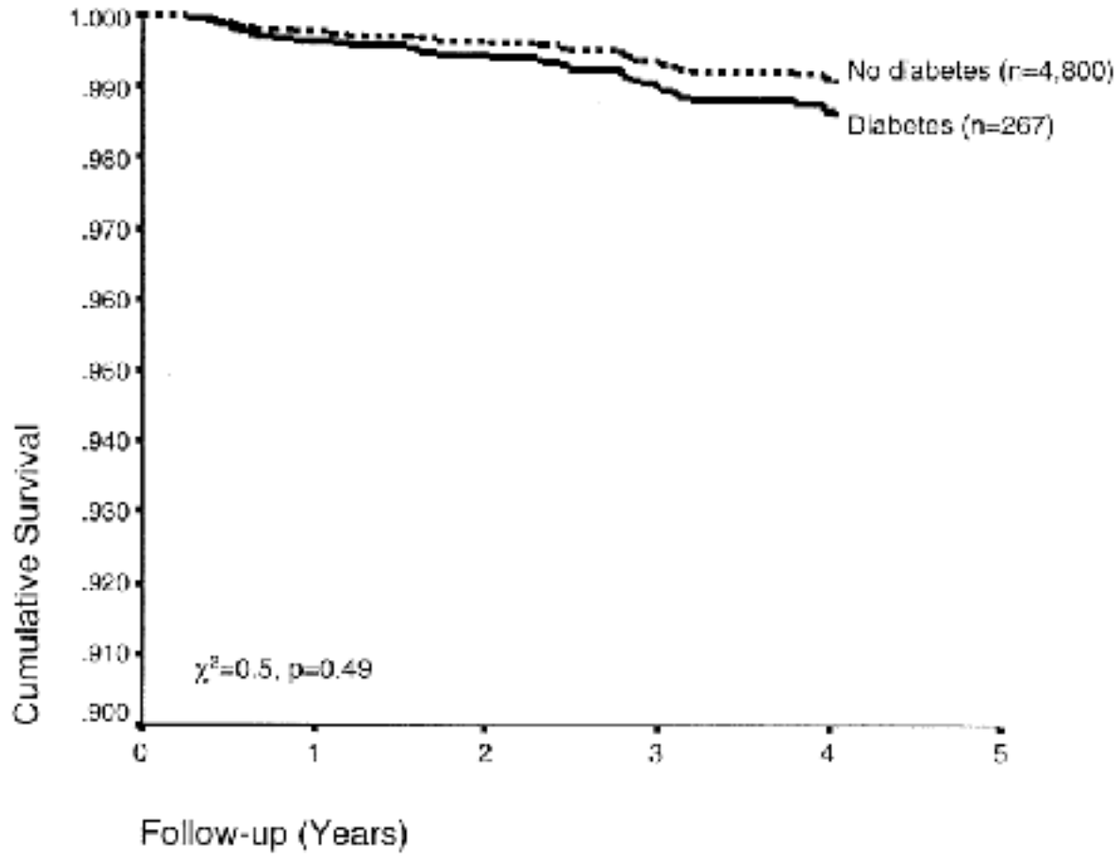




CAC=0

Score calcique

- Plus élevée chez l'homme dans la population générale
- Augmente avec l'âge
- Varie avec origine ethnique

Distribution of Coronary Artery Calcium by Race, Gender, and Age

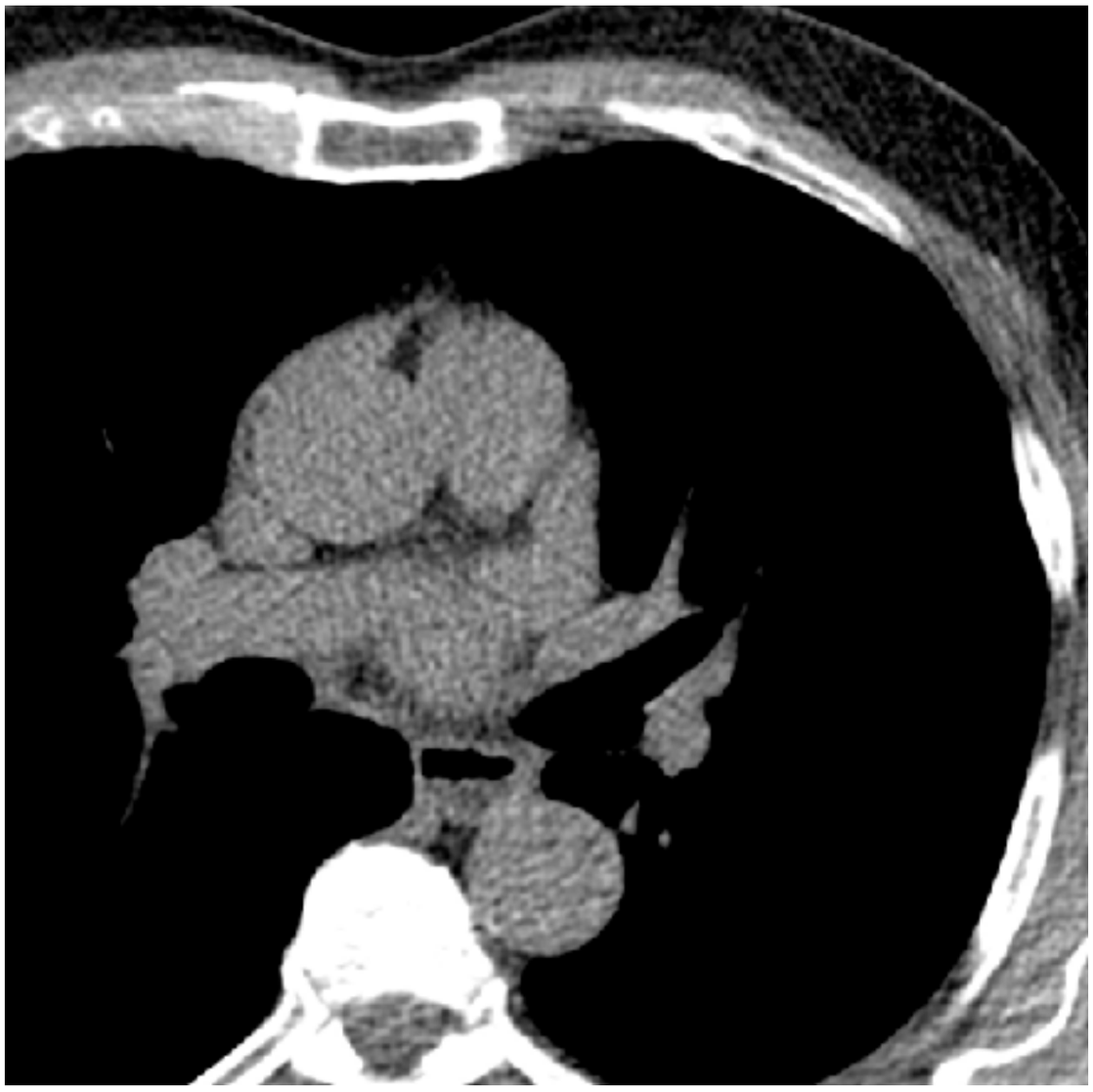
Results from the Multi-Ethnic Study of Atherosclerosis (MESA)

Robyn L. McClelland, PhD; Hyoju Chung, MS; Robert Detrano, MD; Wendy Post, MD, MS; Richard A. Kronmal, PhD

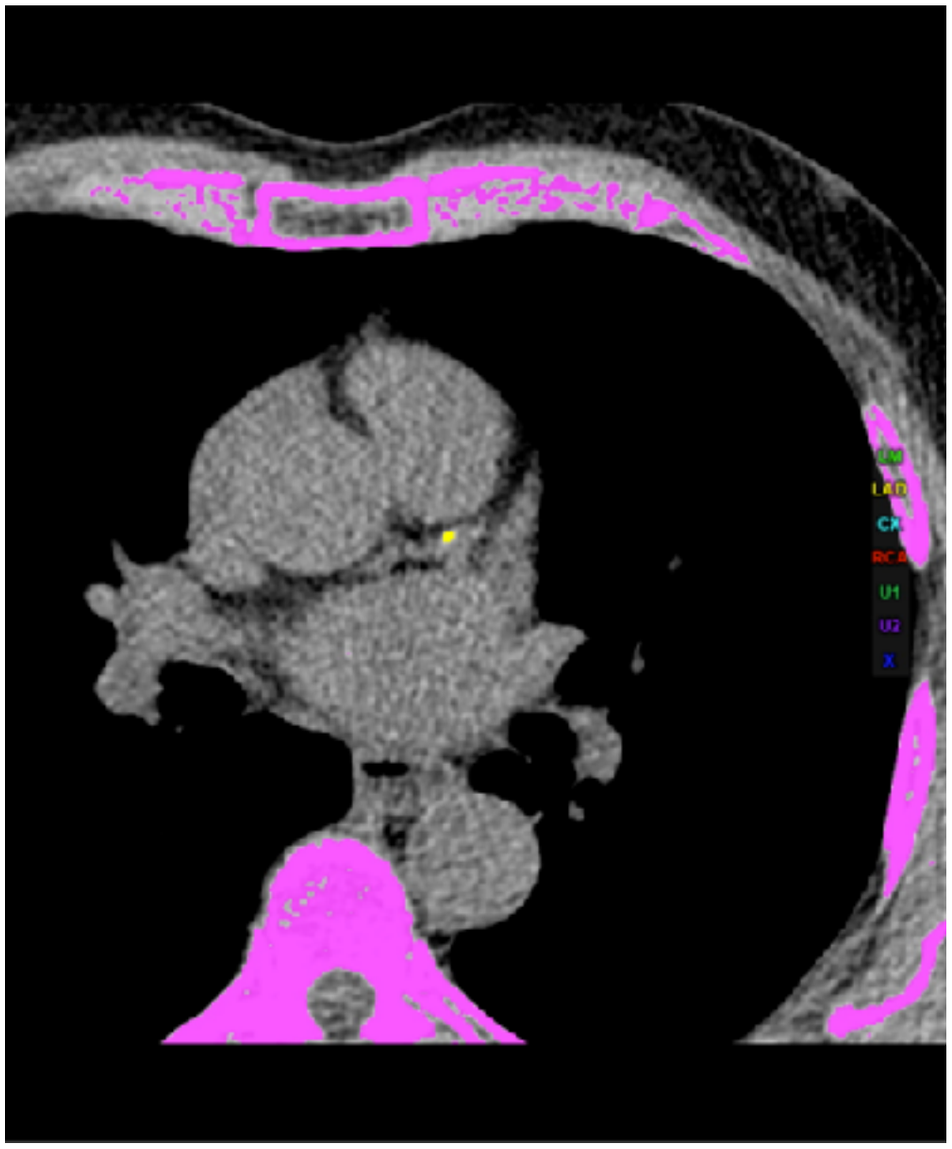
TABLE 2. Estimated Percentiles of CAC by Age Category, Gender, and Race/Ethnicity

	Women, n				Men, n			
	Age, y				Age, y			
Percentiles by Race	45–54	55–64	65–74	75–84	45–54	55–64	65–74	75–84
White, n	379	356	379	194	321	325	375	174
25th	0	0	0	20	0	0	21	103
50th	0	0	13	106	0	28	145	385
75th	0	16	119	370	22	155	540	1200
90th	8	102	391	921	110	452	1345	2933
95th	31	209	674	1535	207	743	2271	4619
Chinese, n	109	107	103	52	102	94	102	50
25th	0	0	0	0	0	0	0	11
50th	0	0	5	32	0	5	34	81
75th	0	18	70	146	14	67	174	305
90th	12	105	246	398	89	242	487	769
95th	44	213	436	656	184	429	803	1299
Black, n	274	241	278	110	214	192	206	98
25th	0	0	0	0	0	0	0	23
50th	0	0	0	47	0	0	32	141
75th	0	5	77	214	2	40	191	516
90th	9	74	310	592	45	173	575	1281
95th	38	173	561	953	105	318	945	2176
Hispanic, n	218	196	169	86	205	177	149	75
25th	0	0	0	0	0	0	1	36
50th	0	0	1	45	0	3	56	153
75th	0	2	51	205	9	75	247	494
90th	2	50	203	557	88	291	666	1221
95th	18	118	361	917	195	512	1091	1943

Score calcique

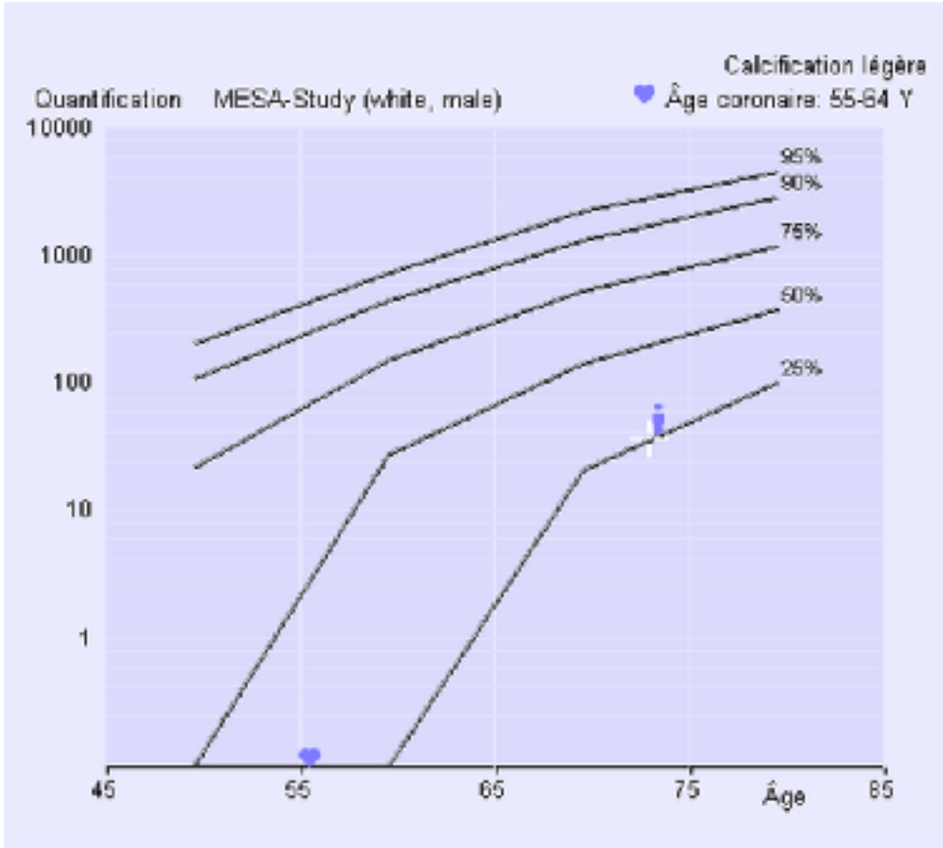


Score calcique

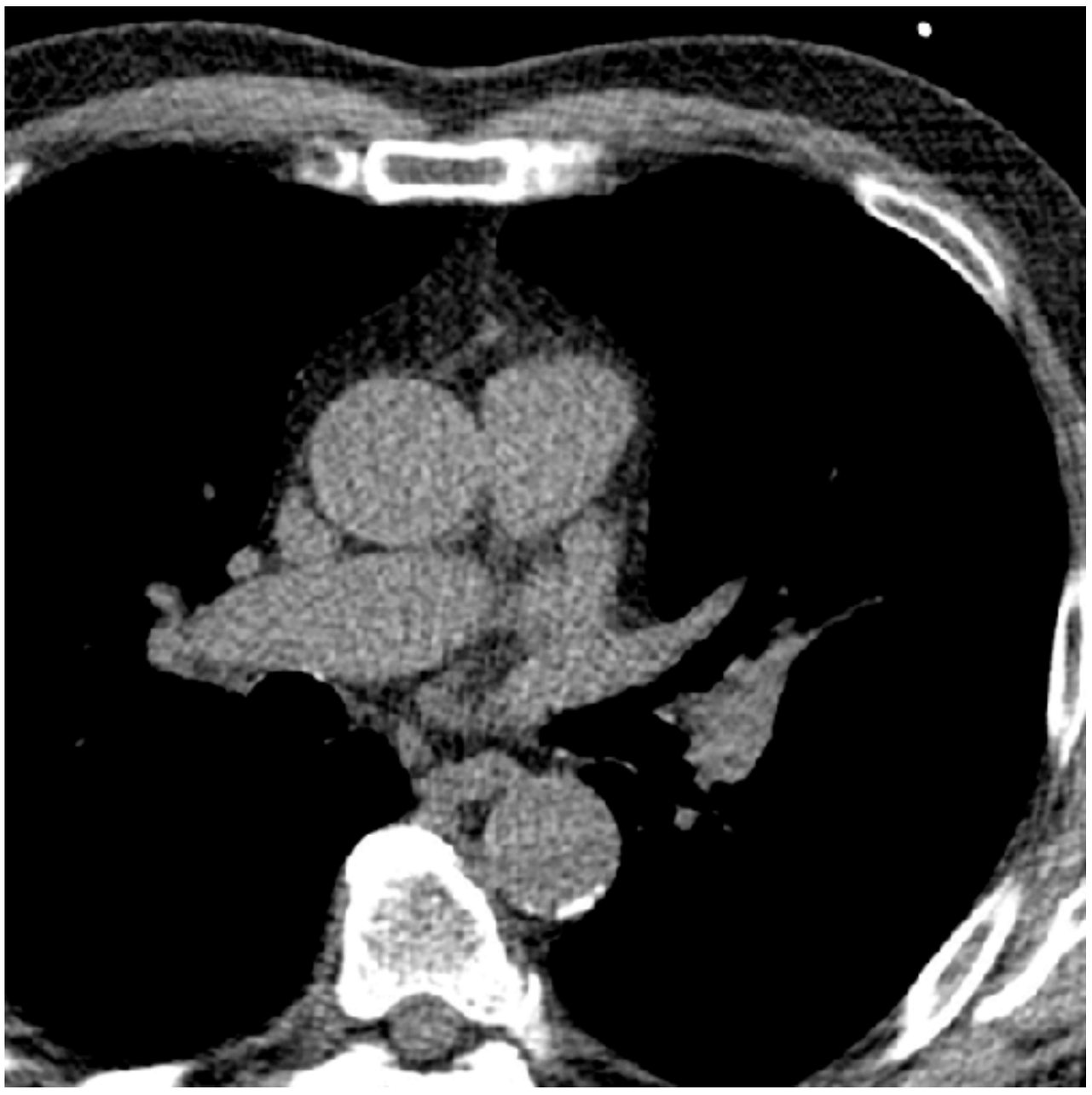


Artère	Lésions	Volume / mm	Masse équiv. / mg	Quantification
LM	2	4,4	0,83	2,3
LAD	3	34,6	6,20	33,3
CX	0	0,0	0,00	0,0
RCA	0	0,0	0,00	0,0
Total	5	39,0	7,03	35,6
U1	0	0,0	0,00	0,0
U2	0	0,0	0,00	0,0

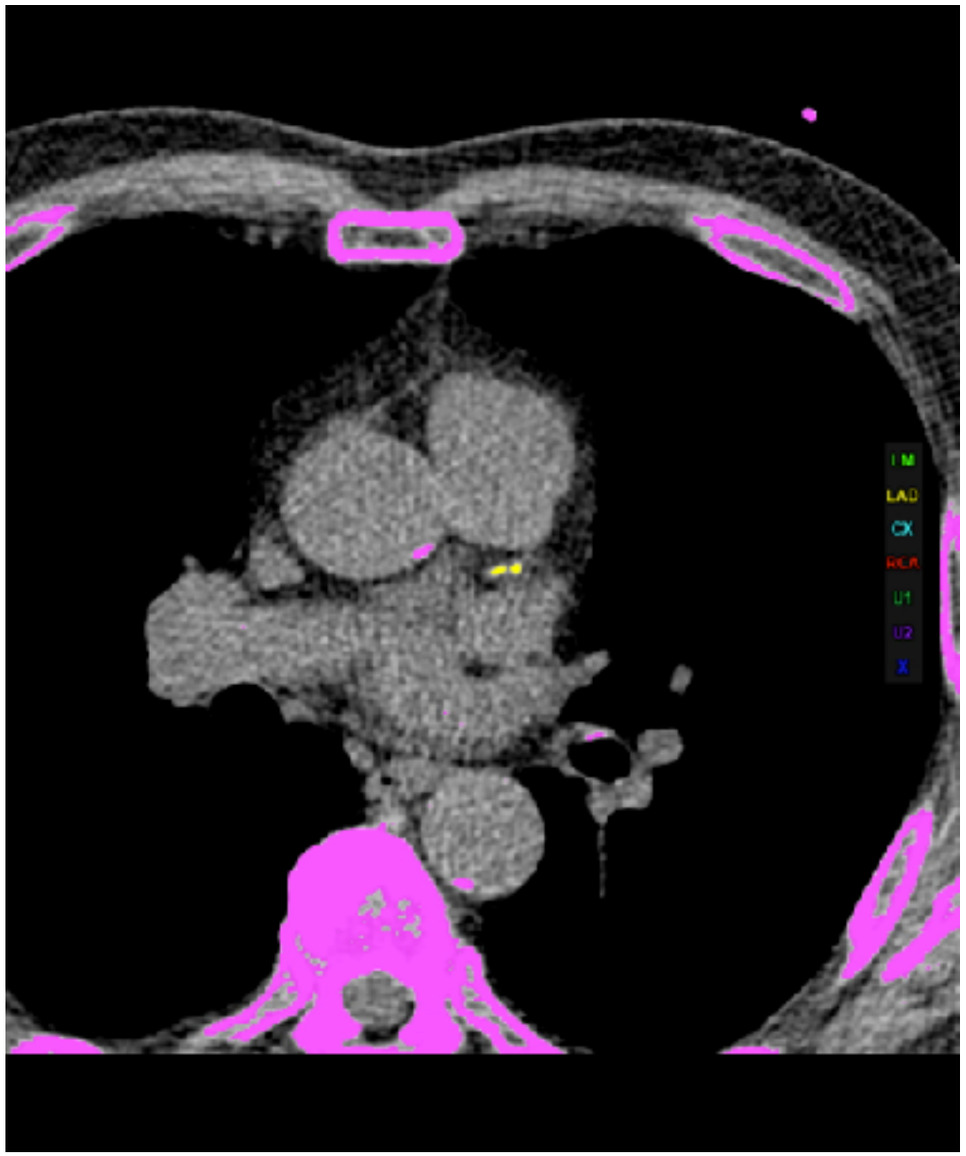
Réglages
Type de quantification: Défini par l'utilisateur, Seuil: 130 HU (105,3 mg/cm³ CaHA)
Facteur de calibration de masse: 0,81



Score calcique

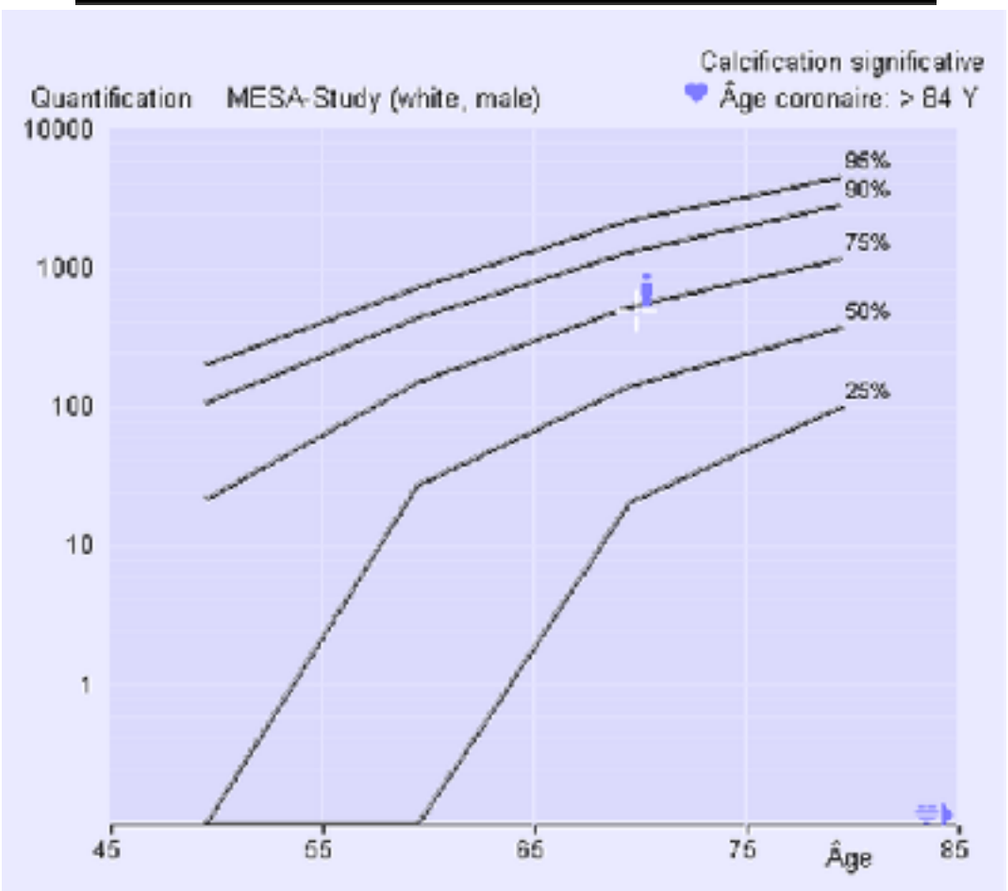


Score calcique

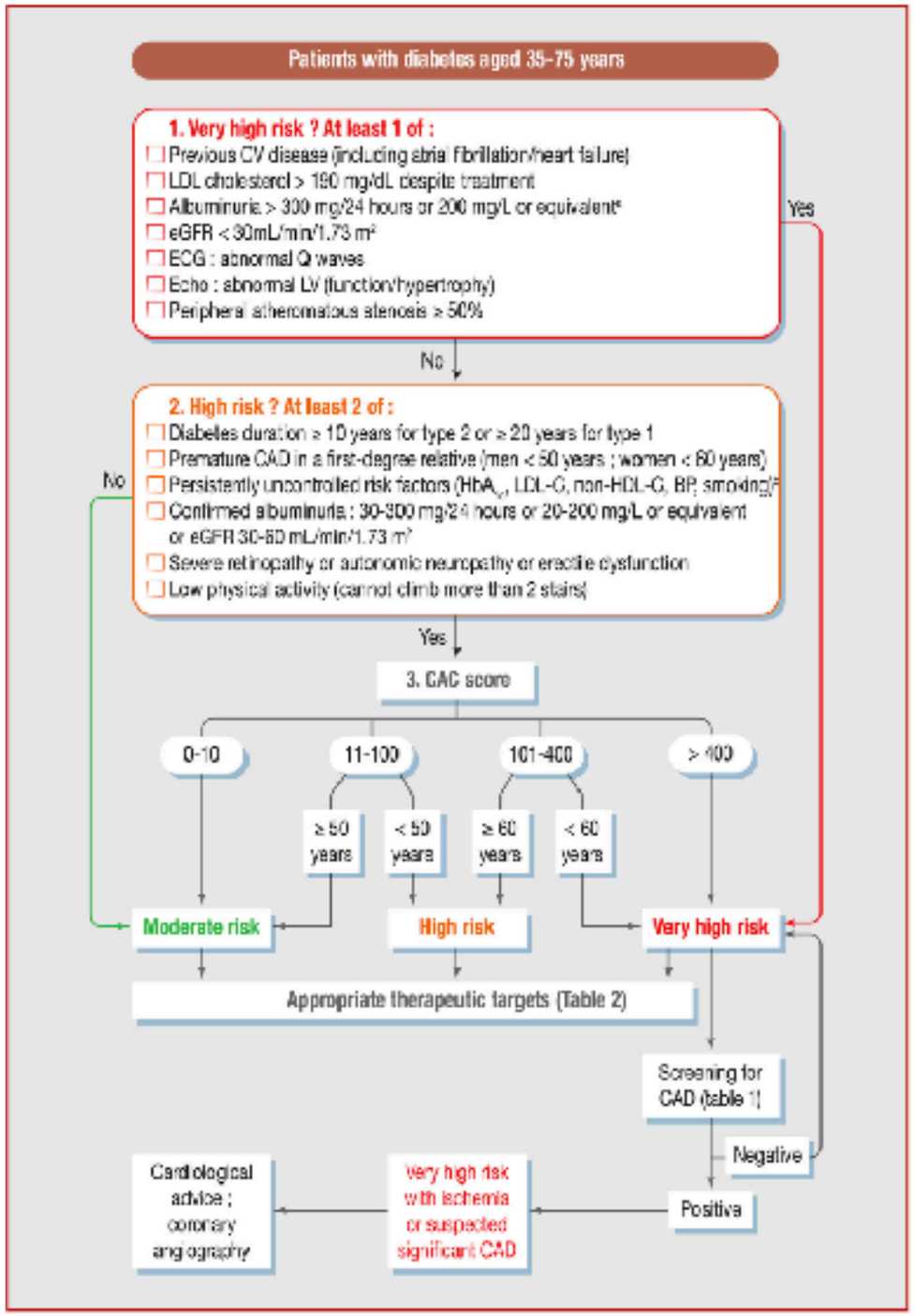


Artère	Lésions	Volume / mm	Masse équiv. / mg	Quantification
LM	0	0,0	0,00	0,0
LAD	7	291,8	70,75	354,8
CX	2	61,5	16,34	78,1
RCA	4	48,8	8,75	43,9
Total	13	402,1	95,83	477,8
U1	0	0,0	0,00	0,0
U2	0	0,0	0,00	0,0

Réglages
Type de quantification: Défini par l'utilisateur, Seuil: 130 HU (105,3 mg/cm³ CaHA)
Facteur de calibration de masse: 0,81



SFC/SFD 2021



réévaluation du risque ts les ans
dépistage CAD 3-5 chez très haut risque restant asymptomatique

Dépistage fonctionnel

- Couplé à l'imagerie
- ischémie + IDM silencieux non détecté à l'ECG
- Scintigraphie, Echographie, IRM
- Disponibilités et expertise locale
- Adapté à chaque patients

IRM de stress

- Pas de rayonnement ionisant
- Pas de PCI
- Pour le moment stress pharmacologique
- Particulièrement intéressant chez diabétiques car détection de l'ischémie et des cicatrice d'IDM passé inaperçu + atteinte microvasculaire
- Très bonne performance diagnostique

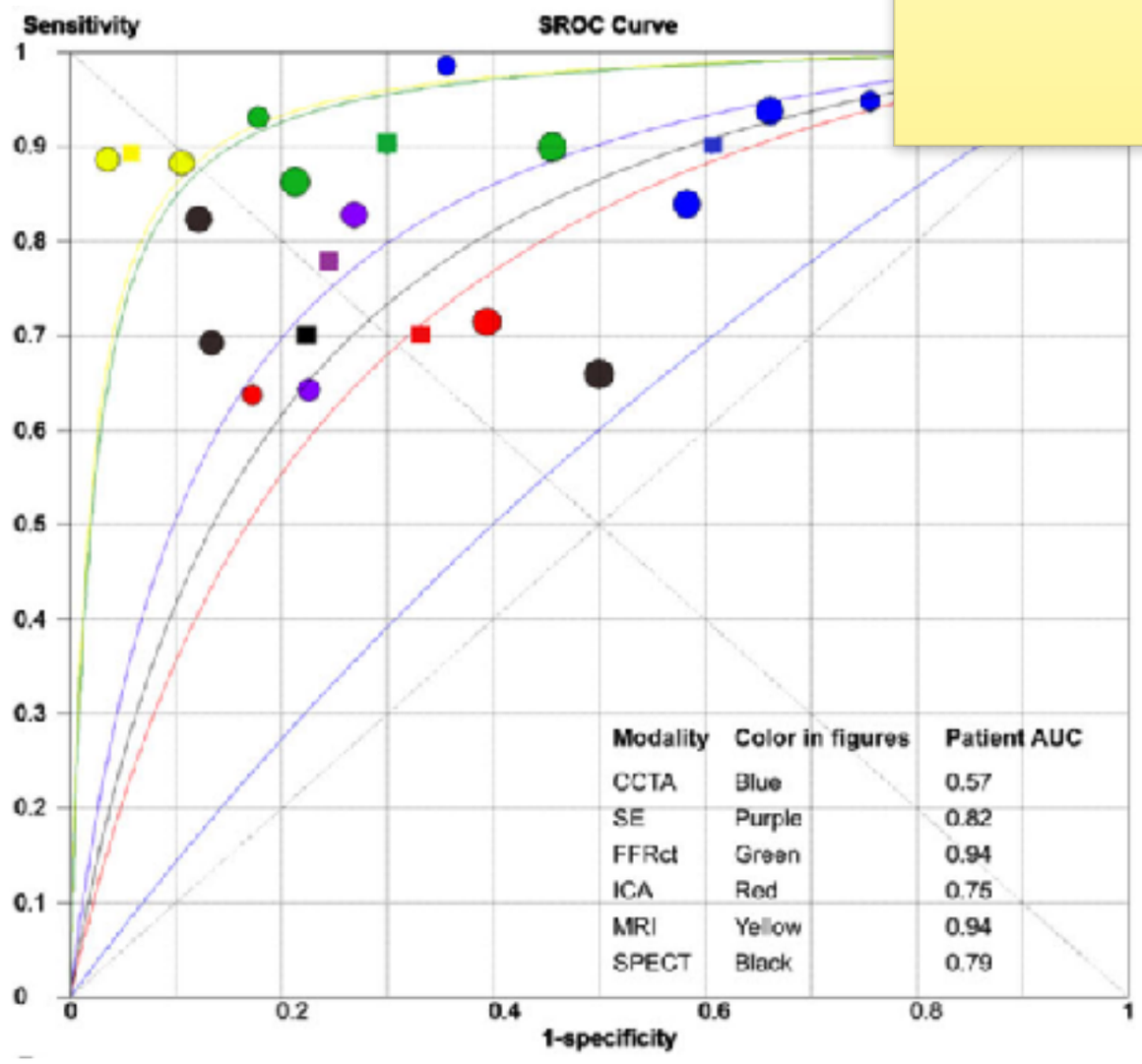
IRM de stress

European Heart Journal (2017) 38, 991–998
doi:10.1093/eurheartj/ehw095

META-ANALYSIS
imaging

Diagnostic performance of cardiac imaging methods to diagnose ischaemia-causing coronary artery disease when directly compared with fractional flow reserve as a reference standard: a meta-analysis

Ibrahim Danad[1,2], Jackie Szymonifka[1,2], Jos W.R. Twisk[3], Bjarne L. Norgaard[4], Christopher K. Zarins[5,6], Paul Knaapen[7], and James K. Min[1,2]*



excellente performance diagnos
manque disponibilité, pourrait êt
réservée à cas complexes

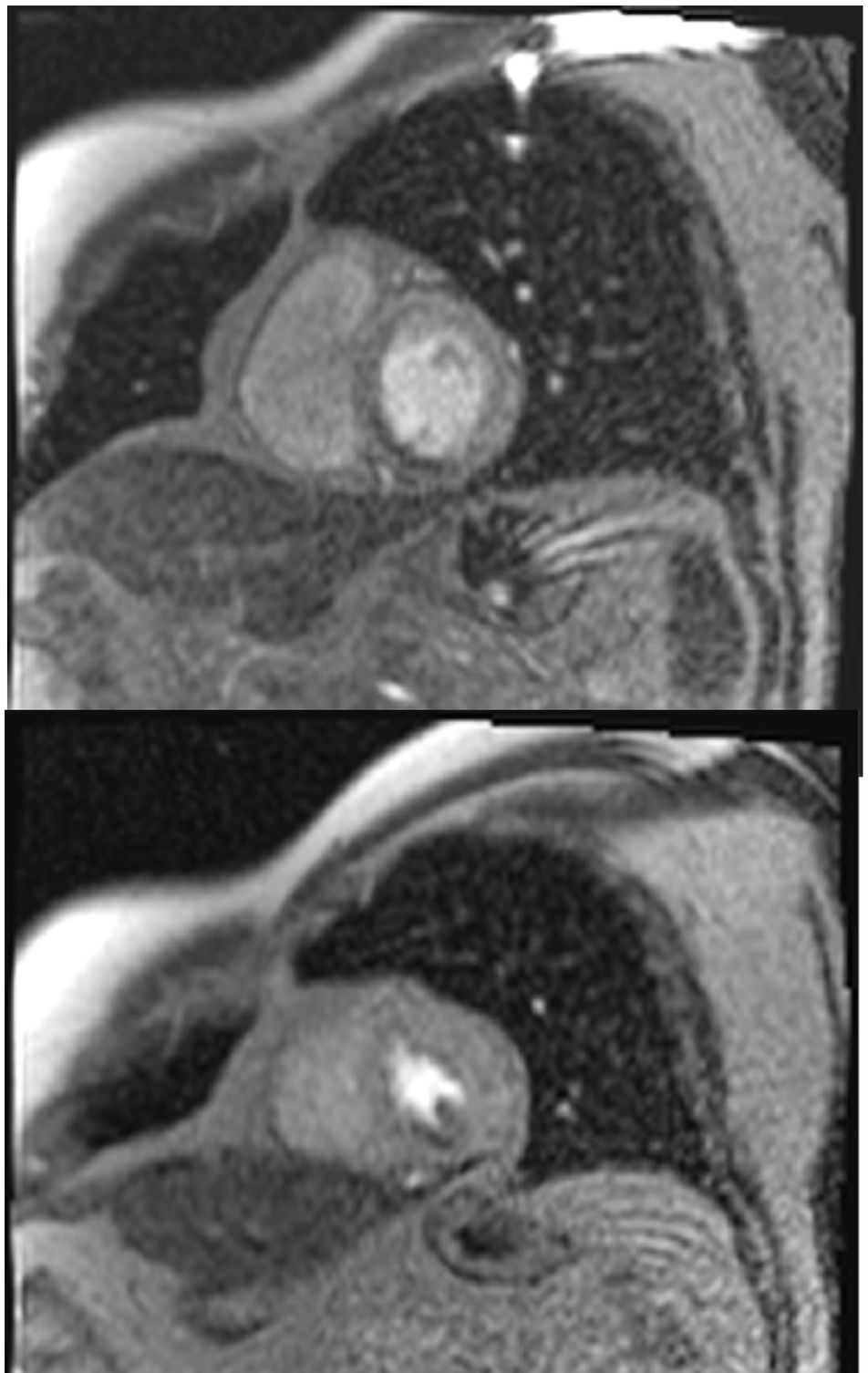
IRM de stress

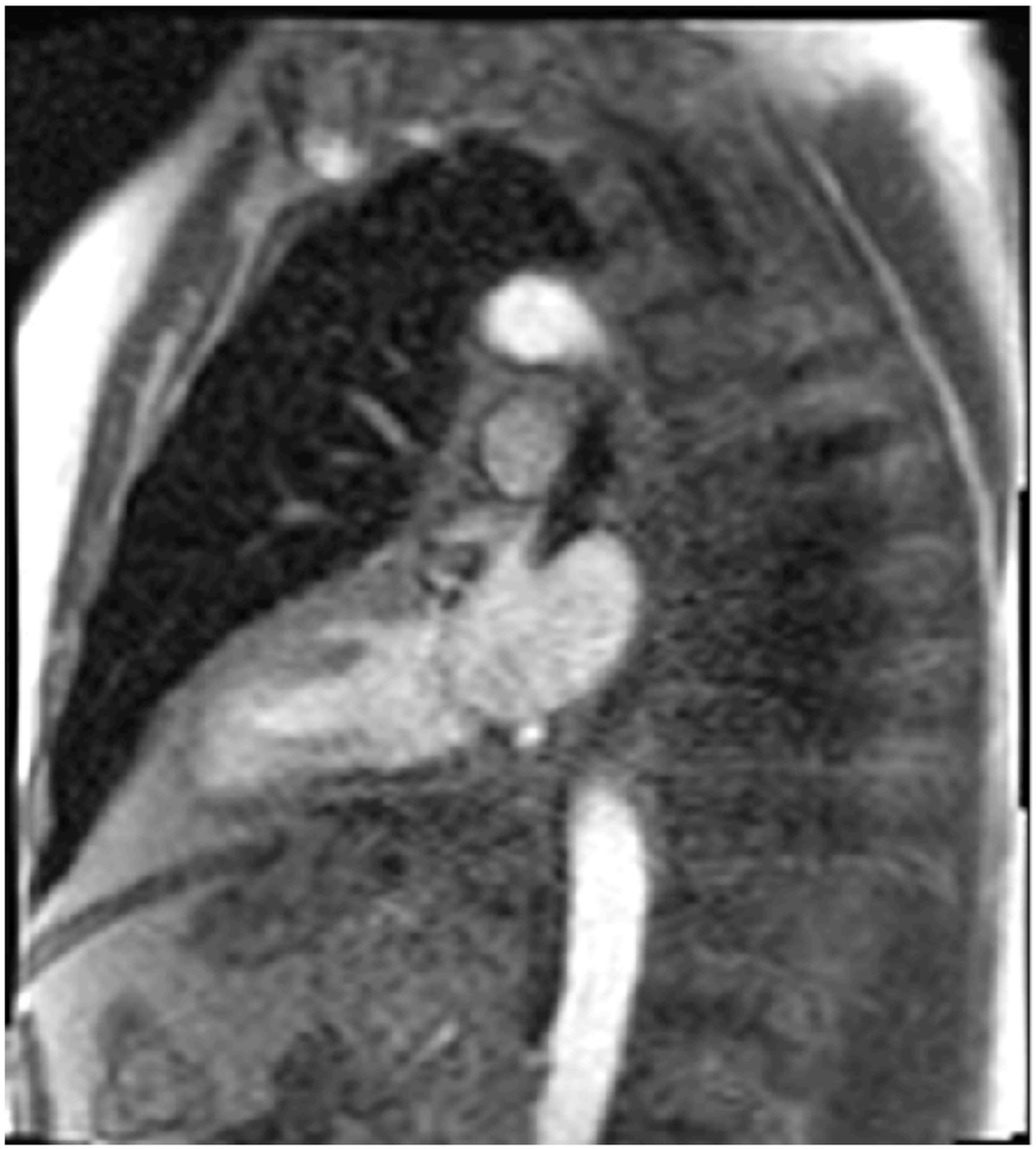
- Analyse de la perfusion de premier passage du Gadolinium sous vasodilatateur (dipyridamol, adénosine, regadenoson) (préférée)

- Analyse de la cinétique segmentaire sous dobutamine (possible)

- Protocole de base avec séquences ciné et séquences de rehaussement tardif

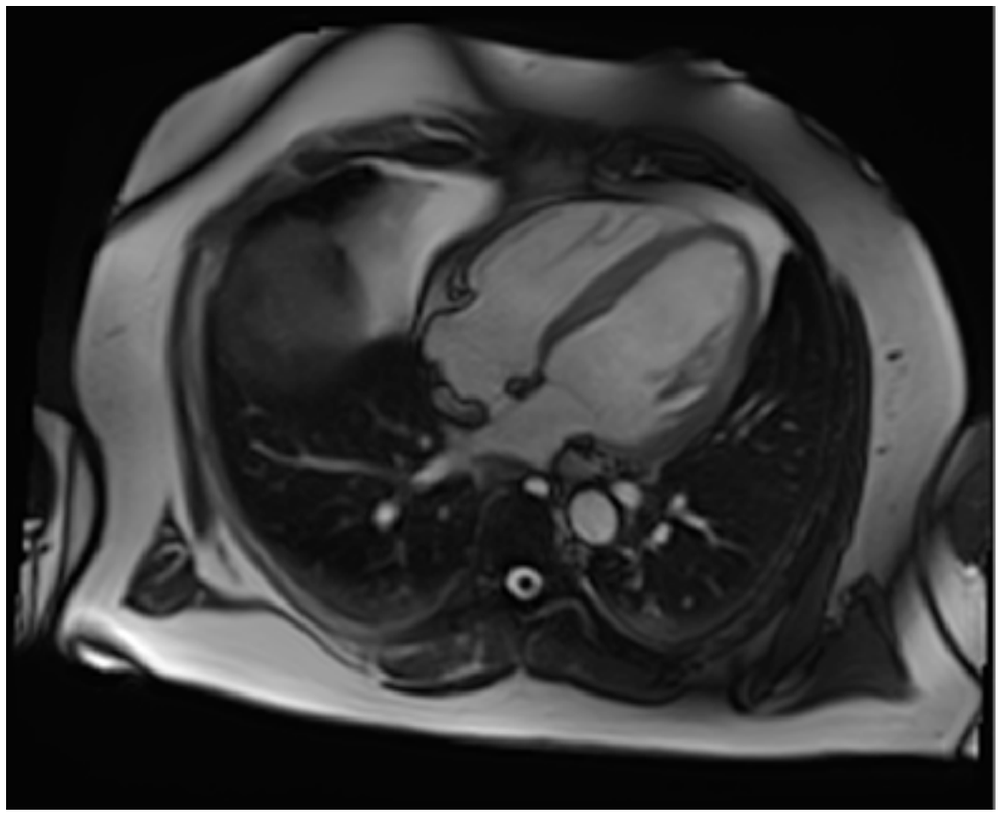
IRM de stress

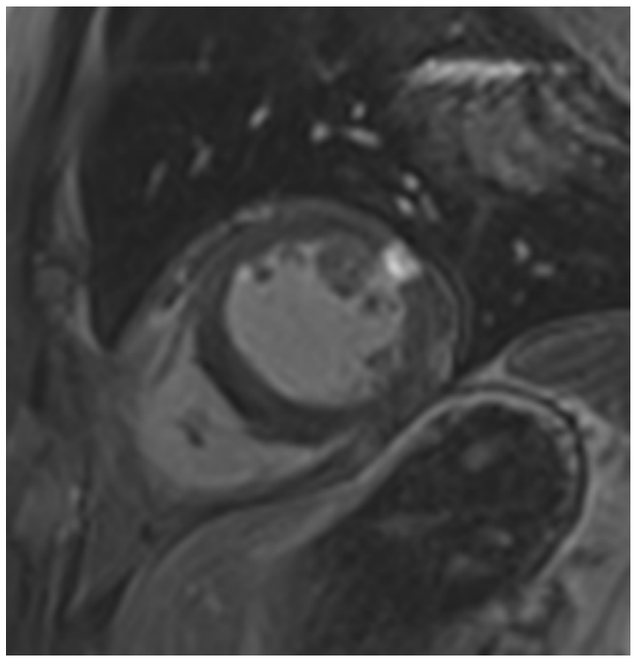


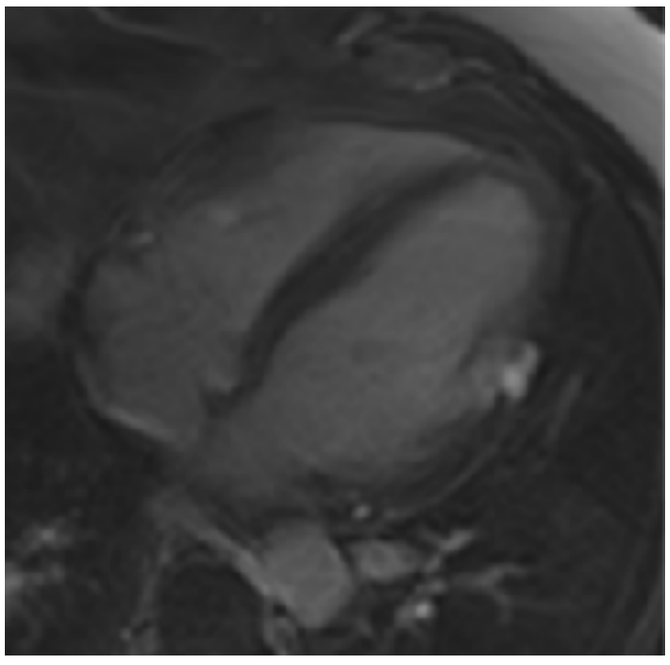


IDM passé inaperçu

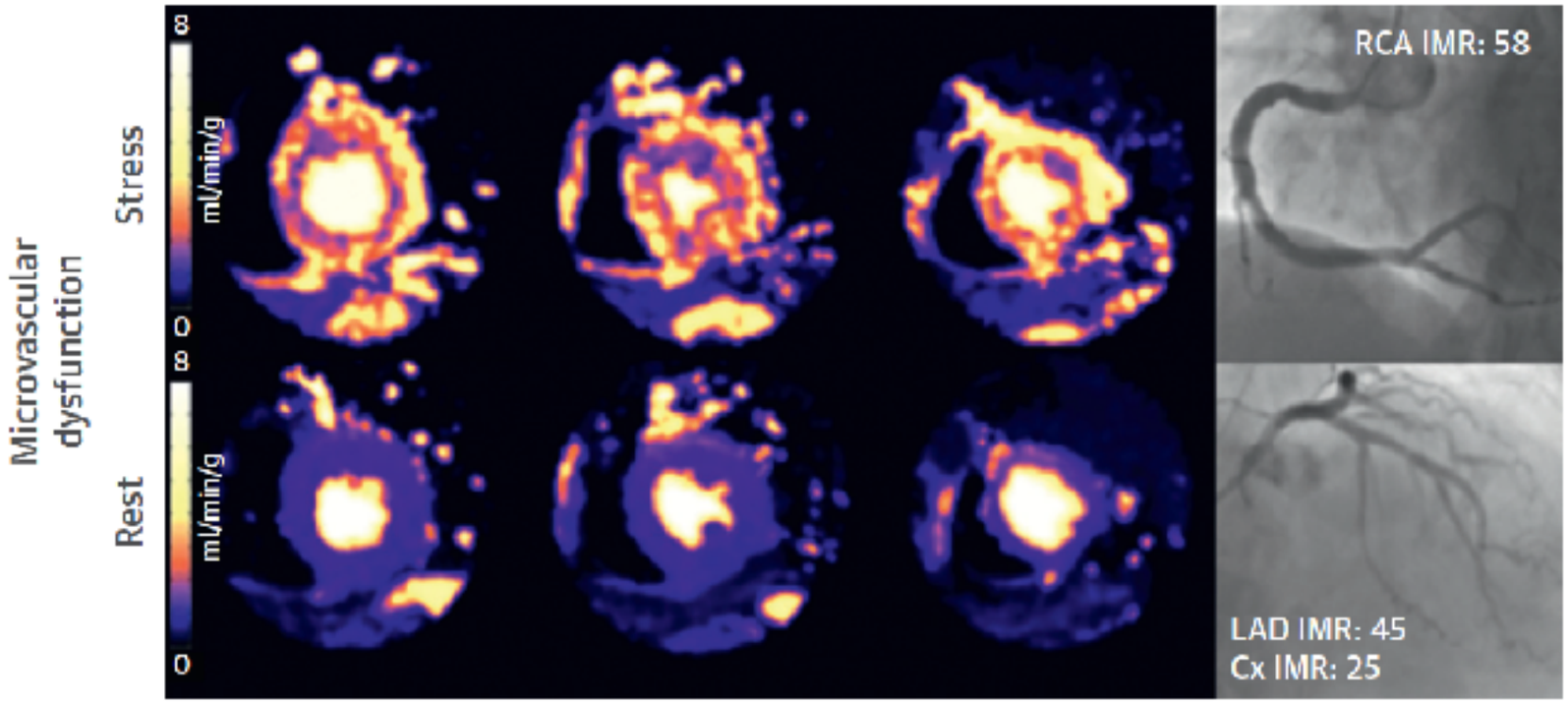
- IRM=“Gold standard” pour la détection de cicatrice fibreuse myocardite (rehaussement tardif)
- Associé à mauvais pronostique







IRM de stress quantitative



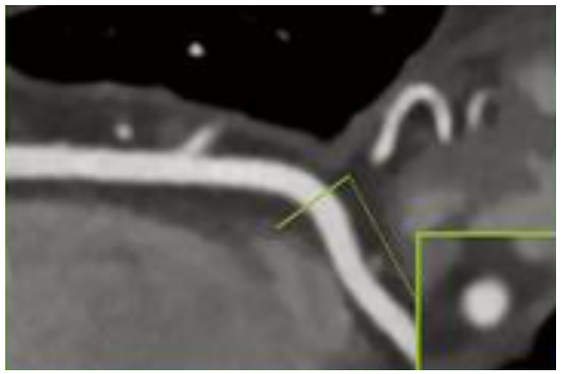
Kotecha et al. JACC Cardiovasc Imaging 2019

- Quantification du flux de perfusion myocardique (voxel)
- Mesure de l'index de résistance microvasculaire
- Bonne corrélation avec mesures invasives
- Pas encore disponible en pratique clinique mais automatisation des mesures grâce à l'AI pourrait les rendre plus accessibles

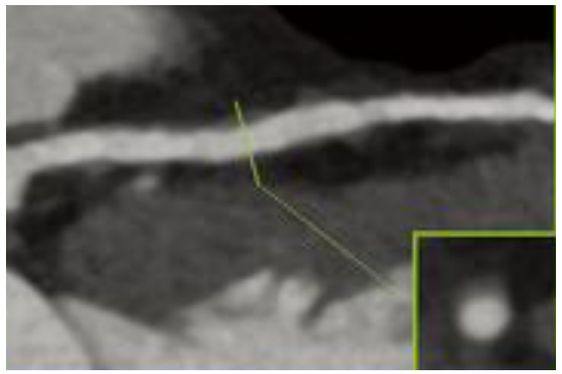
Dépistage anatomique

- Scanner coronaire
- Patient symptomatique à faible probabilité pré-test car très bonne valeur prédictive négative (classe I ESC 2019)
- Patient diabétique asymptomatique (classe IIb ESC 2019)
- Visualisation et localisation de l'athérome coronaire (tritronculaires, lésions proximales)
- Quantification des sténoses
- Caractérisation des plaques
- +/- FFRCT

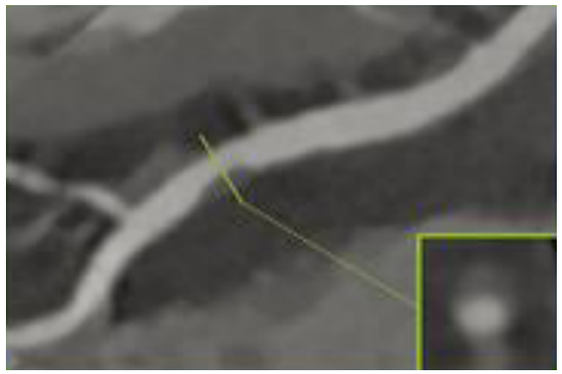
Quantification des sténoses



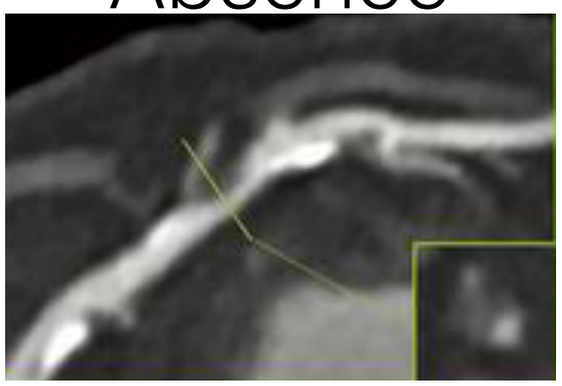
Absence



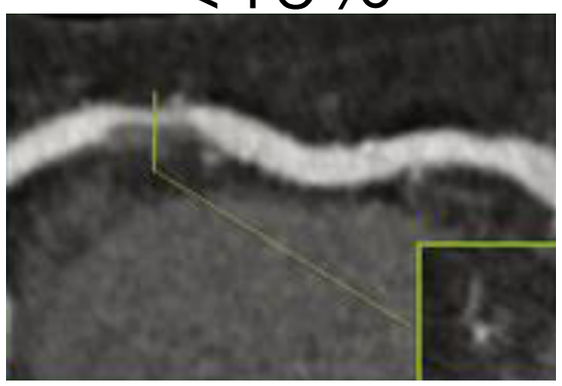
<10%



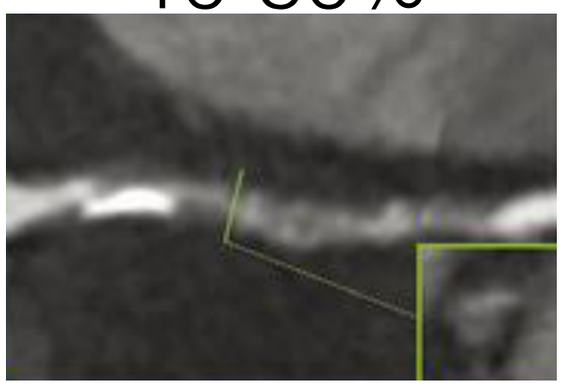
10-50%



50-70%

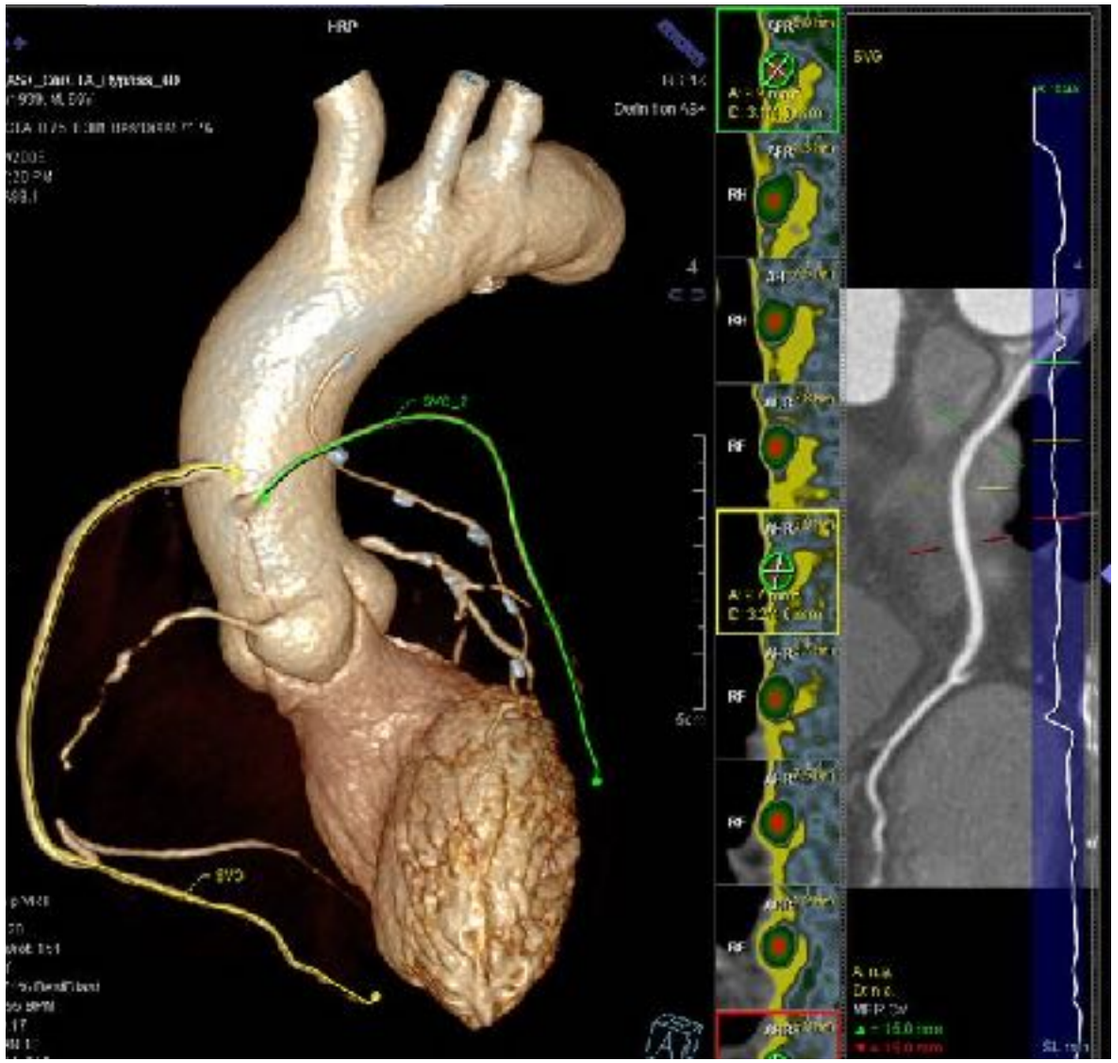


>70%

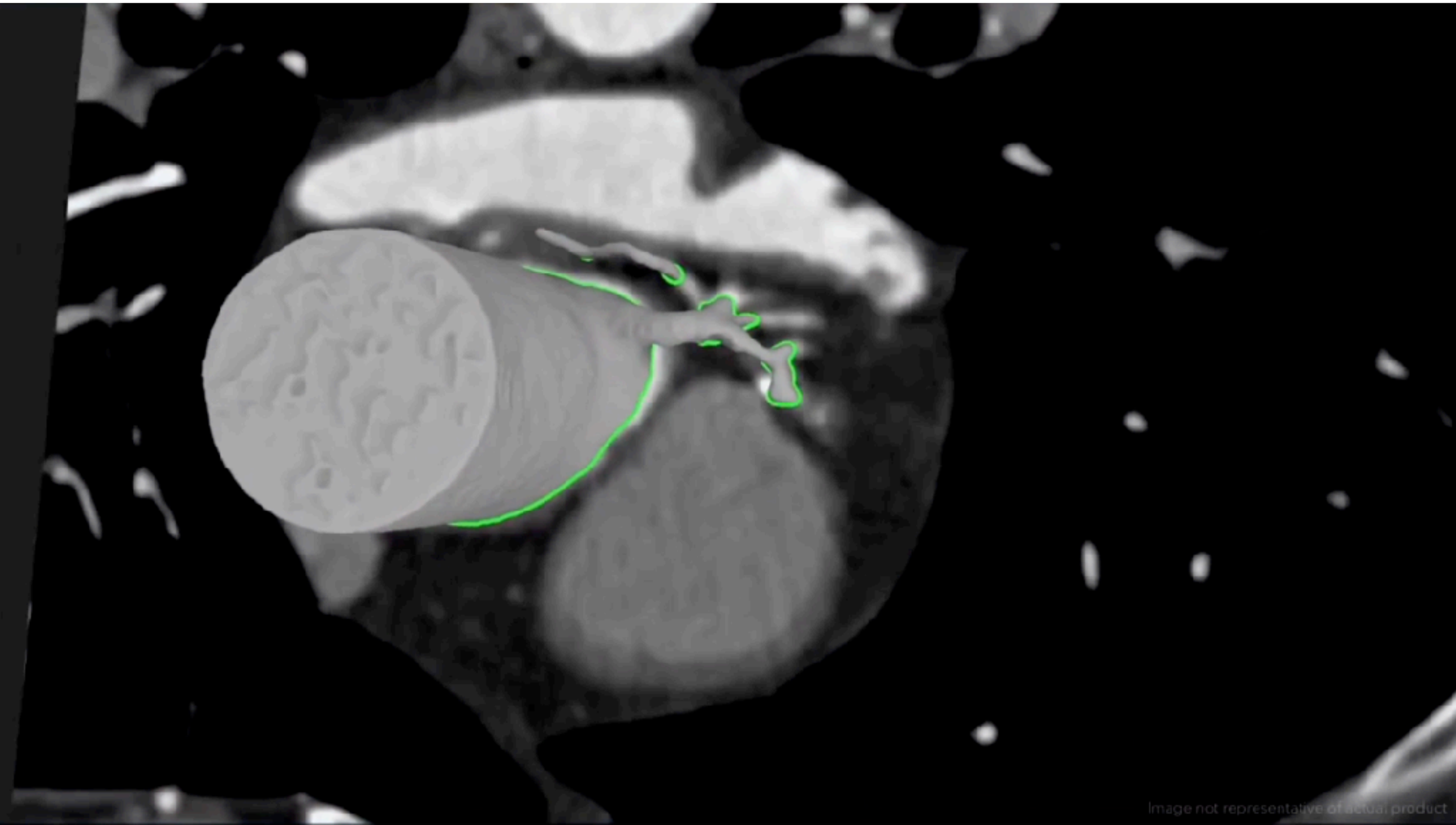


Occlusion

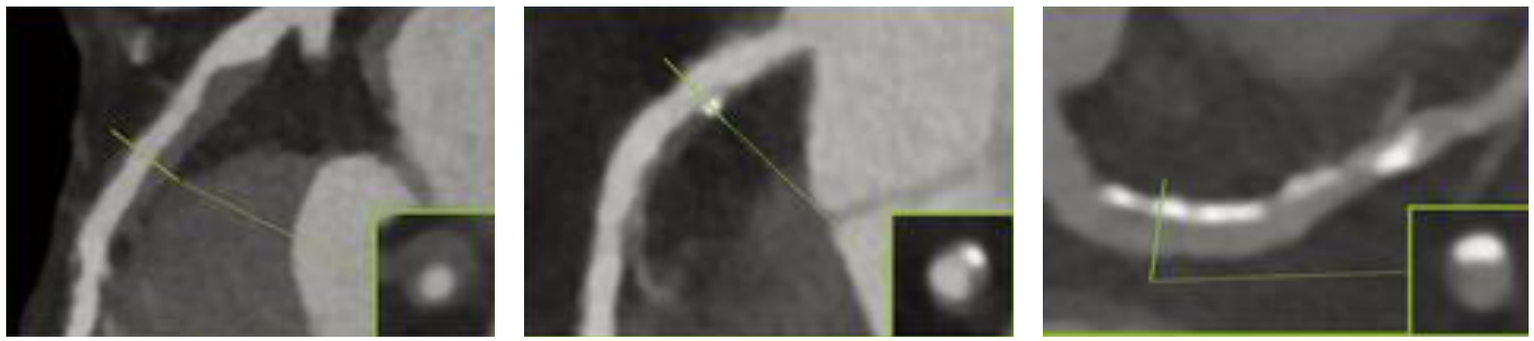
Quantification des sténoses



Simulation de FFR basée sur les images de scanner coronaire

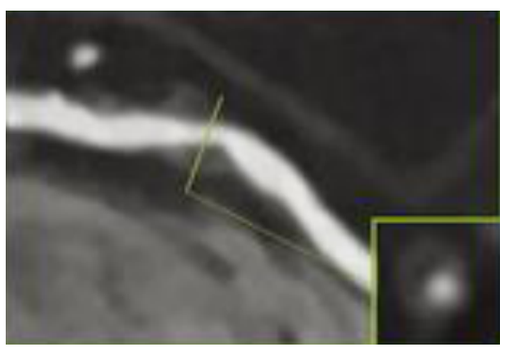


Caractérisation des plaques

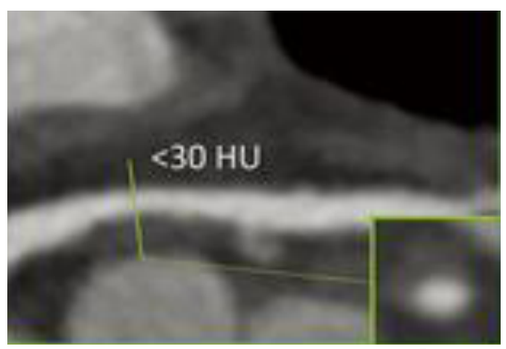


Non calcifiée Mixte Calcifiée

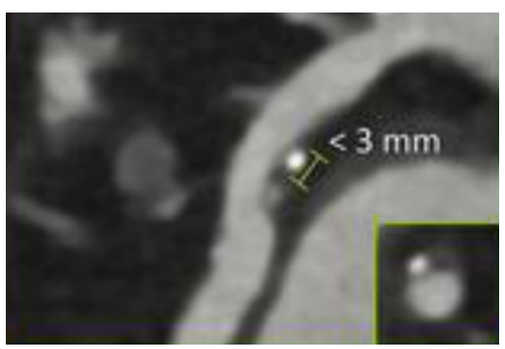
Plaque à haut risque



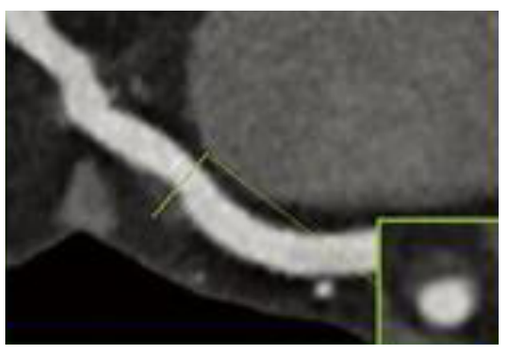
Napkin-ring



Faible densité



Calcification “spotty”



Remodelage positif

JACC: CARDIOVASCULAR IMAGING
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ORIGINAL RESEARCH

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

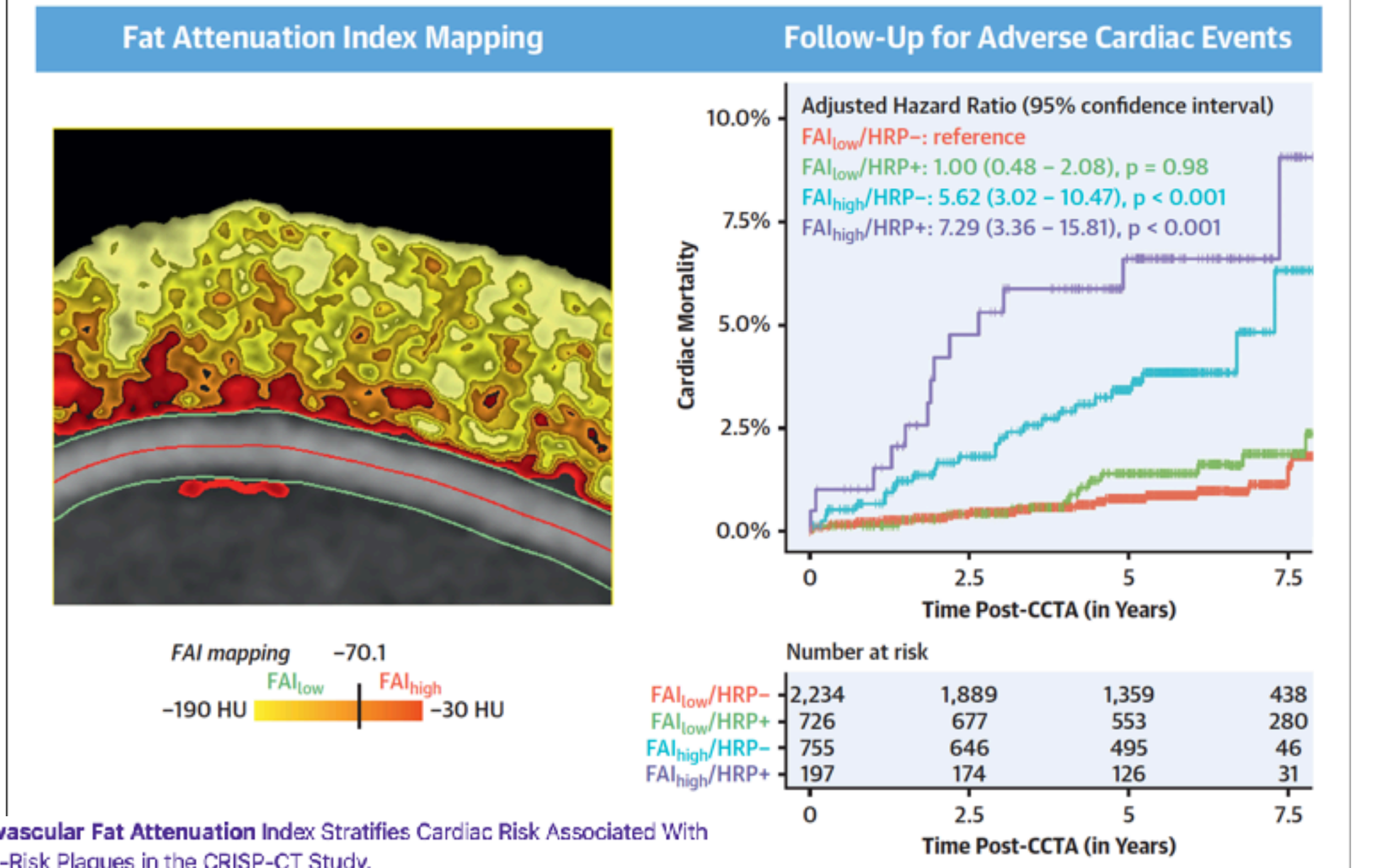
A Long-Term Observational Study

David A. Halon, MB ChB,[a] Idit Lavi, MPH,[b] Ofra Barnett-Griness, PhD,[b] Ronen Rubinshtein, MD,[c] Barak Zafrir, MD,[d] Mali Azencot, PhD,[a] Basil S. Lewis, MD[a,c]

- Etude prospective 500 sujets diabétique de type 2, asymptomatiques suivi pdt 9 ans
- CCTA analysé pour 630 patients, 130 exclus car pas d'athérome coronaires
- 25 SCA
- 3 marqueurs d'instabilité: volume de la plaque, hypodensité (<50UH), légère calcification
- Plaques très calcifiée stables

Autour de la plaque

FIGURE 1 Perivascular FAI Stratifies the Risk Associated With HRP Features



Perivascular Fat Attenuation Index Stratifies Cardiac Risk Associated With High-Risk Plaques in the CRISP-CT Study.

Oikonomou EK, Desai MY, Marwan M, Kotanidis CP, Antonopoulos AS, Schottlander D, Channon KM, Neubauer S, Achenbach S, Antoniades C.

J Am Coll Cardiol. 2020 Aug 11;76(6):755–757. doi: 10.1016/j.jacc.2020.05.078.

Cas clinique

- Homme de 47 ans
- Diabète de type 1 depuis l'âge de 15 ans
- Bon équilibre du diabète avec HbA1c autour de 7%
- Pas d'autres FDR CV (LDL 0,93 HDL 0,51 CT 1,55)
- Asymptomatique pour un bon niveau d'effort
- Pas de microangiopathie

Cas clinique

- Examen clinique normal
- TA 110/70
- ECG RS 52 bpm sans particularité
- Echoscopie: normal pour l’âge

Cas clinique

Table 7 Cardiovascular risk categories in patients with diabetes[a]

Very high risk	Patients with DM **and** established CVD **or** other target organ damage[b] **or** three or more major risk factors[c] **or** early onset T1DM of long duration (>20 years)
High risk	Patients with DM duration >10 years without target organ damage plus any other additional risk factor
Moderate risk	Young patients (T1DM aged <35 years or T2DM aged <50 years) with DM duration <10 years, without other risk factors

CV = cardiovascular; CVD = cardiovascular disease; DM = diabetes mellitus; T1DM = type 1 diabetes mellitus; T2DM = type 2 diabetes mellitus.

[a]Modified from the 2016 European Guidelines on cardiovascular disease prevention in clinical practice.[27]

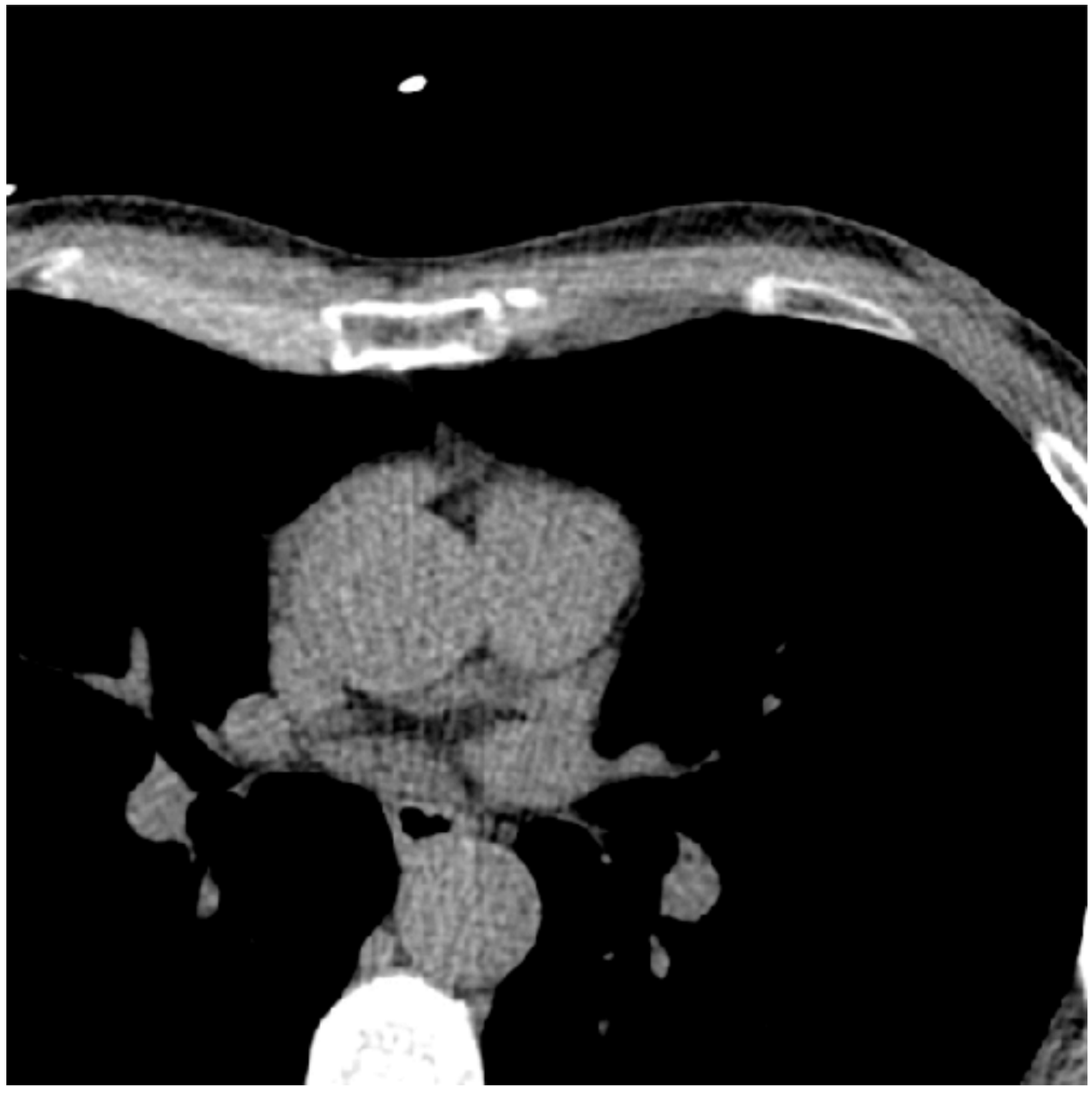
[b]Proteinuria, renal impairment defined as eGFR <30 mL/min/1.73 m^2, retinal hypertrophy, or retinopathy.

[c]Age, hypertension, dyslipidemia, smoking, obesity.

Recommendations for the management of dyslipidaemia with lipid-lowering drugs

Recommendations	Class[a]	Level[b]
Targets		
In patients with T2DM at moderate CV risk,[c] an LDL-C target of <2.6 mmol/L (<100 mg/dL) is recommended.[210–212]	I	A
In patients with T2DM at high CV risk,[c] an LDL-C target of <1.8 mmol/L (<70 mg/dL) and LDL-C reduction of at least 50% is recommended.[d,210–212]	I	A
In patients with T2DM at very high CV risk,[c] an LDL-C target of <1.4 mmol/L (<55 mg/dL) and LDL-C reduction of at least 50% is recommended.[d,200,201,213]	I	B
In patients with T2DM, a secondary goal of a non-HDL-C target of <2.2 mmol/L (<85 mg/dL) in very high CV-risk patients, and <2.6 mmol/L (<100 mg/dL) in high CV-risk patients, is recommended.[d,213,214]	I	B

Cas clinique



Cas clinique

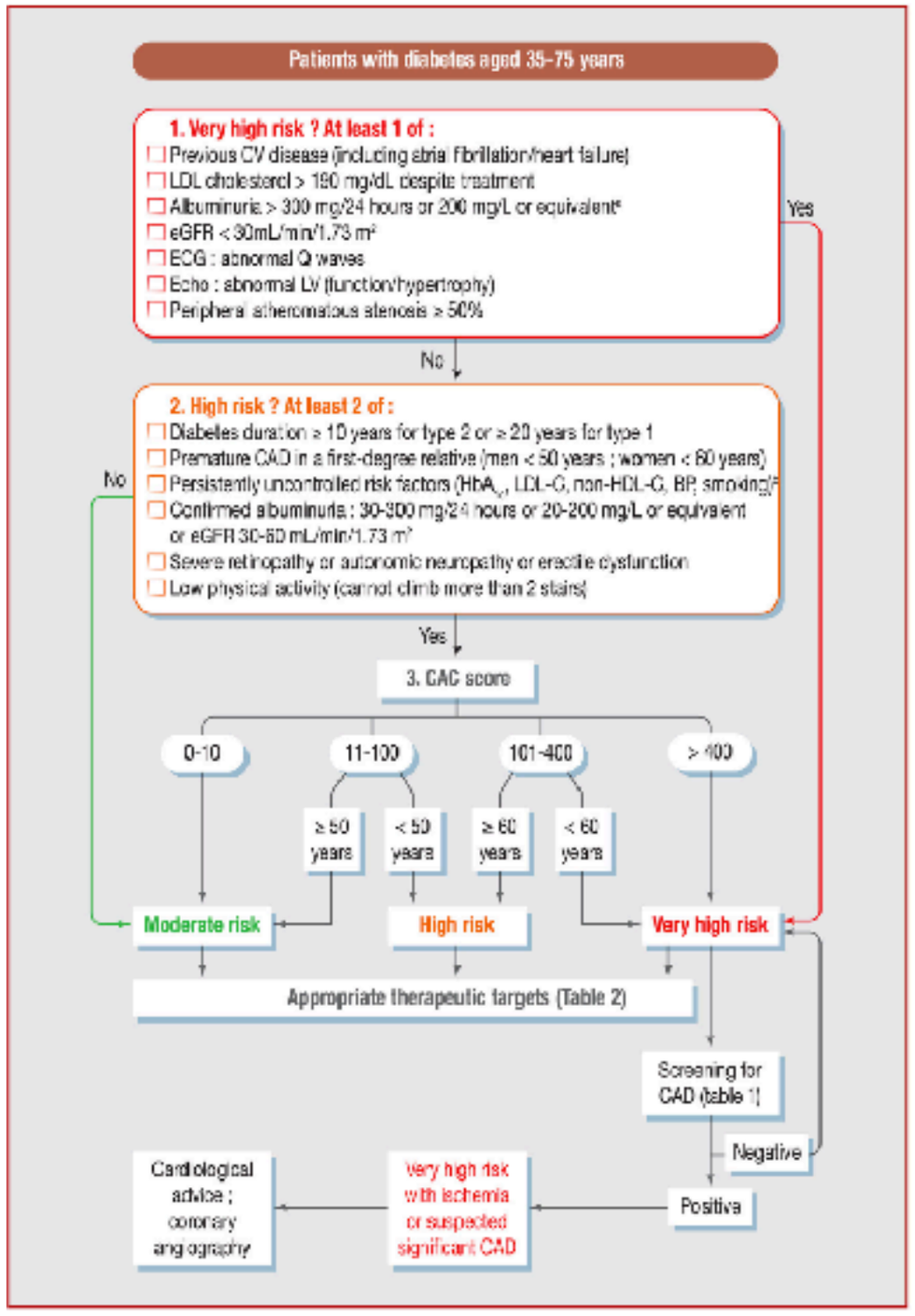


Table 2 Therapeutic targets according to risk category.

	Moderate risk	High risk	Very high risk	Very high risk with suspected significant CAD	Comments
Target HbA1c	< 7%	< 7%	7%	7%	Consider the patient profile—less stringent goal in frail patients
Avoid hypoglycaemia	+	+	+++	+++	Mainly with insulin/sulfonylureas/glinide treatments
Use of GLP-1 RAs		++	+++	+++	Consider different drug profiles
Use of SGLT2 inhibitors		++	+++	+++	Particular benefit for the prevention of heart and renal failure
LDL-C target (mg/dL)	< 100	< 70	< 55	< 55	Statin ± ezetimibe—PCSK9 inhibitors may be considered
Secondary lipid goal: non-HDL-C (mg/dL)	< 130	< 100	< 85	< 85	Fenofibrate could be proposed in specific patients
Smoking cessation	+++	+++	+++	+++	Use a structured smoking cessation programme with pharmacological agents if necessary
Blood pressure target (mmHg)	130/80	130/80	130/80	130/80	Target 130/80 mmHg or lower if well tolerated Not < 120/70 mmHg
Use of RAAS blockers		++	+++	+++	Cardiac and kidney protection
Aspirin 75–100 mg/day	No	No	+	++	If low risk of bleeding—PPI can be added
Physical activity	+++	+++	+++ Rehabilitation	+++ Rehabilitation	Adapted to each patient—initial exercise test can help 150 minutes/week divided into 3 sessions Target heart rate: < 80% predicted maximum heart rate (220—age)
Diet	++	++	+++	+++	Weight loss support in overweight patients Favour a Mediterranean diet
Algorithm reassessment	Each year	Each year	NA	NA	For cardiac echo and duplex examination, reassessment should be according to local practice
CAC score reassessment	No	3–5 years	No	No	CAC is a risk modifier
CAD screening reassessment	No	No	3–5 years[a]	3–5 years[a]	If initial screening is negative If symptoms (chest pain or dyspnoea) occur, immediate reassessment

CAC: coronary artery calcium; CAD: coronary artery disease; GLP1-RA: glucagon-like peptide 1 receptor agonist; HbA1c: glycated haemoglobin; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; NA: not applicable; PCSK9: proprotein convertase subtilisin/kexin type 9; PPI: proton pump inhibitor; RAAS: renin-angiotensin-aldosterone system; SGLT2: sodium-glucose co-transporter-2.

Conclusion

- Population diabétique très hétérogène
- Stratification du risque dédiée (CAC, FDR liés au diabète)
- Test diagnostique fonctionnel ou anatomique pour les patients à très haut risque
- Evidence Gap: intérêt du dépistage