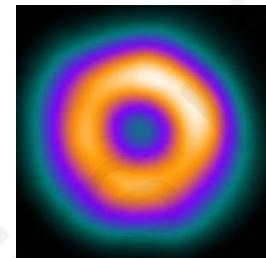


Impact clinique des indices microcirculatoire et prise en charge



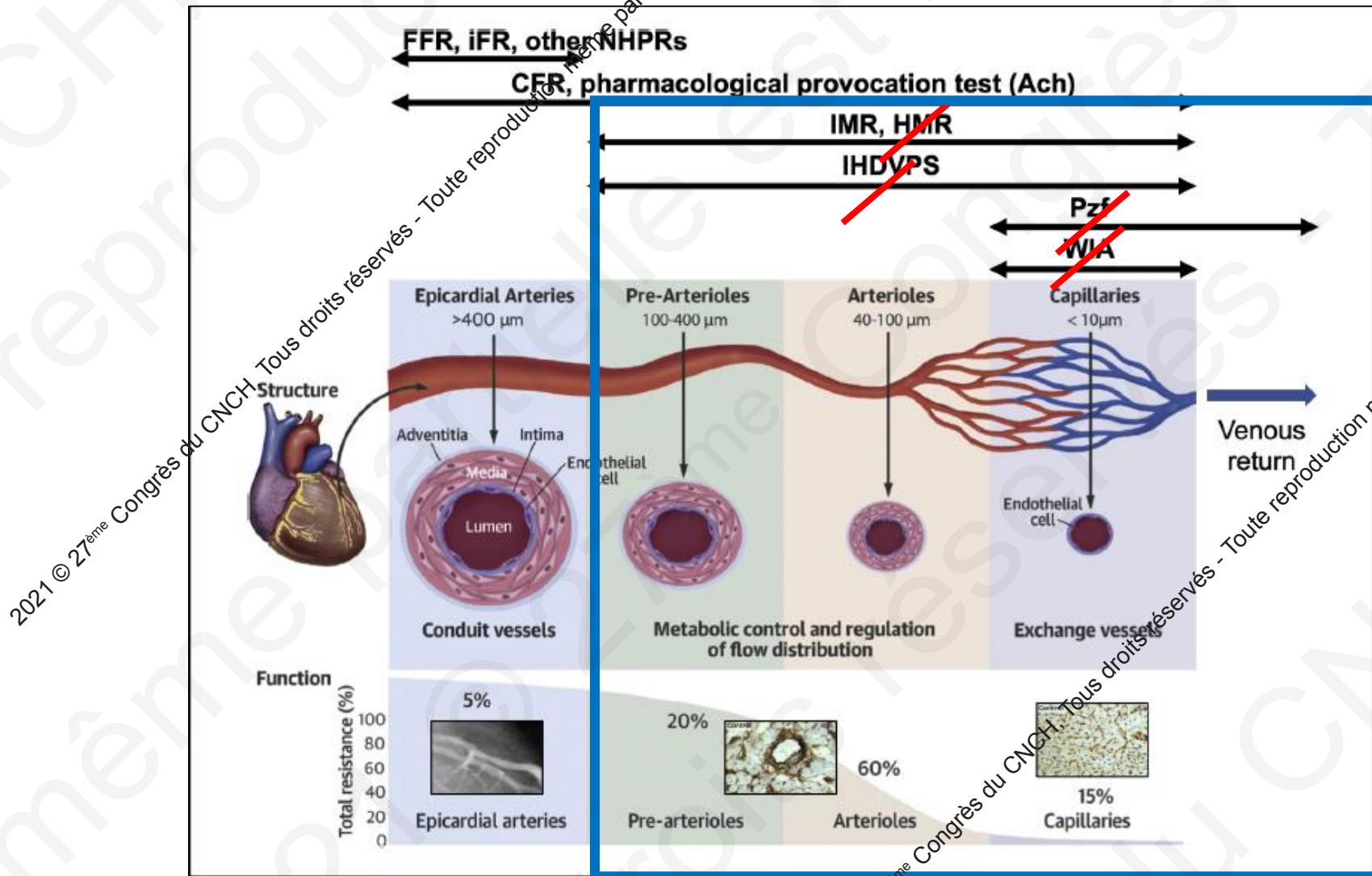
Pr Gilles Barone-Rochette

Interventional cardiology and cardiac imaging
Pôle Thorax et vaisseaux²⁰²¹ CHU de Grenoble
Inserm 1039

Disclosure

- Consulting: Abbott Vascular, Bayer, Novonordisk
- Honoraria: **Bayer, AMGEN, Sanofi, AstraZeneca, Novonordisk, Novartis**
Pfizer, Boehringer Ingelheim
- Grants: MDS, Pfizer, Bayer, Abbott vascular

Several index

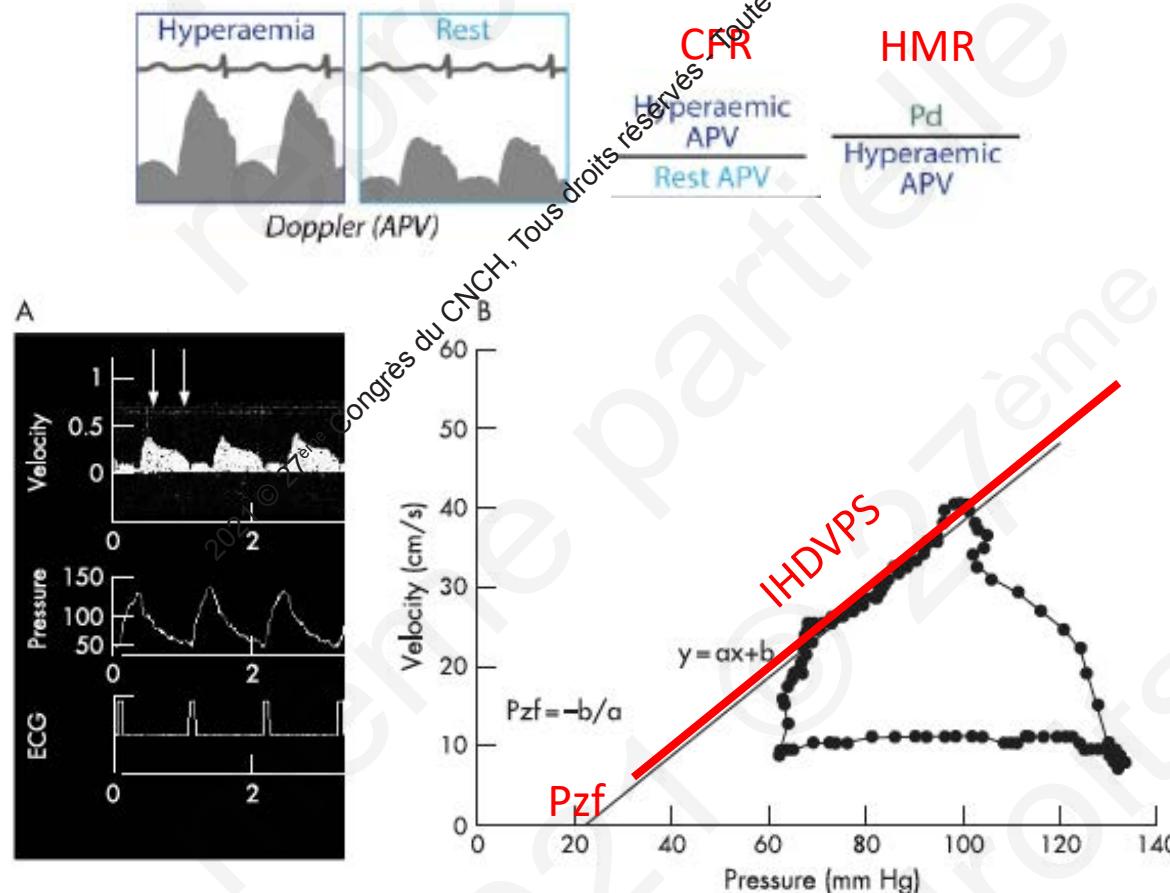


Doppler vs thermodilution

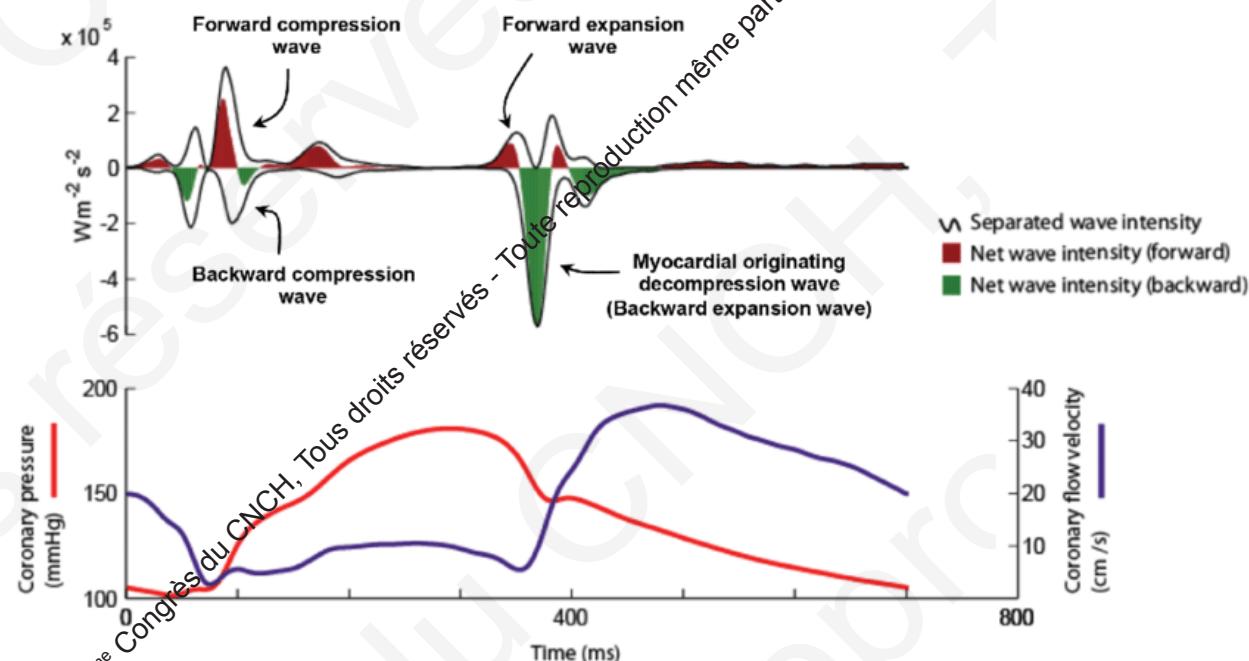
An optimal optimal Doppler tracing could be obtained in 69% of the patients.

Optimal thermo tracing could be obtained in 95% of the patients.

Barbato et al. Eur Heart J. 2004;25:219-23



Wave intensity was calculated as the product of the derivatives of distal coronary pressure and flow velocity, each with respect to time ($d(\text{distal coronary pressure})/dt \times d(\text{flow velocity})/dt$), and wave separation performed as previously



Van Herck et al. Heart 2007;93:1231–1237

Sen S et al. Curr Cardiol Rev. 2014;10:17-23

Clinical impact

- Diagnosis – ANOCA or INOCA
- Prognosis: Identification of patients at risk

Diagnosis

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Investigations in patients with suspected coronary microvascular angina

Recommendations	Class ^a	Level ^b
Guidewire-based CFR and/or microcirculatory resistance measurements should be considered in patients with persistent symptoms, but coronary arteries that are either angiographically normal or have moderate stenoses with preserved iwFR/FFR. ^{412,413}	IIa	B
Intracoronary acetylcholine with ECG monitoring may be considered during angiography, if coronary arteries are either angiographically normal or have moderate stenoses with preserved iwFR/FFR, to assess microvascular vasospasm. ^{412,438–440}	IIb	B
Transthoracic Doppler of the LAD, CMR, and PET may be considered for non-invasive assessment of CFR. ^{430–432,441}	IIb	B

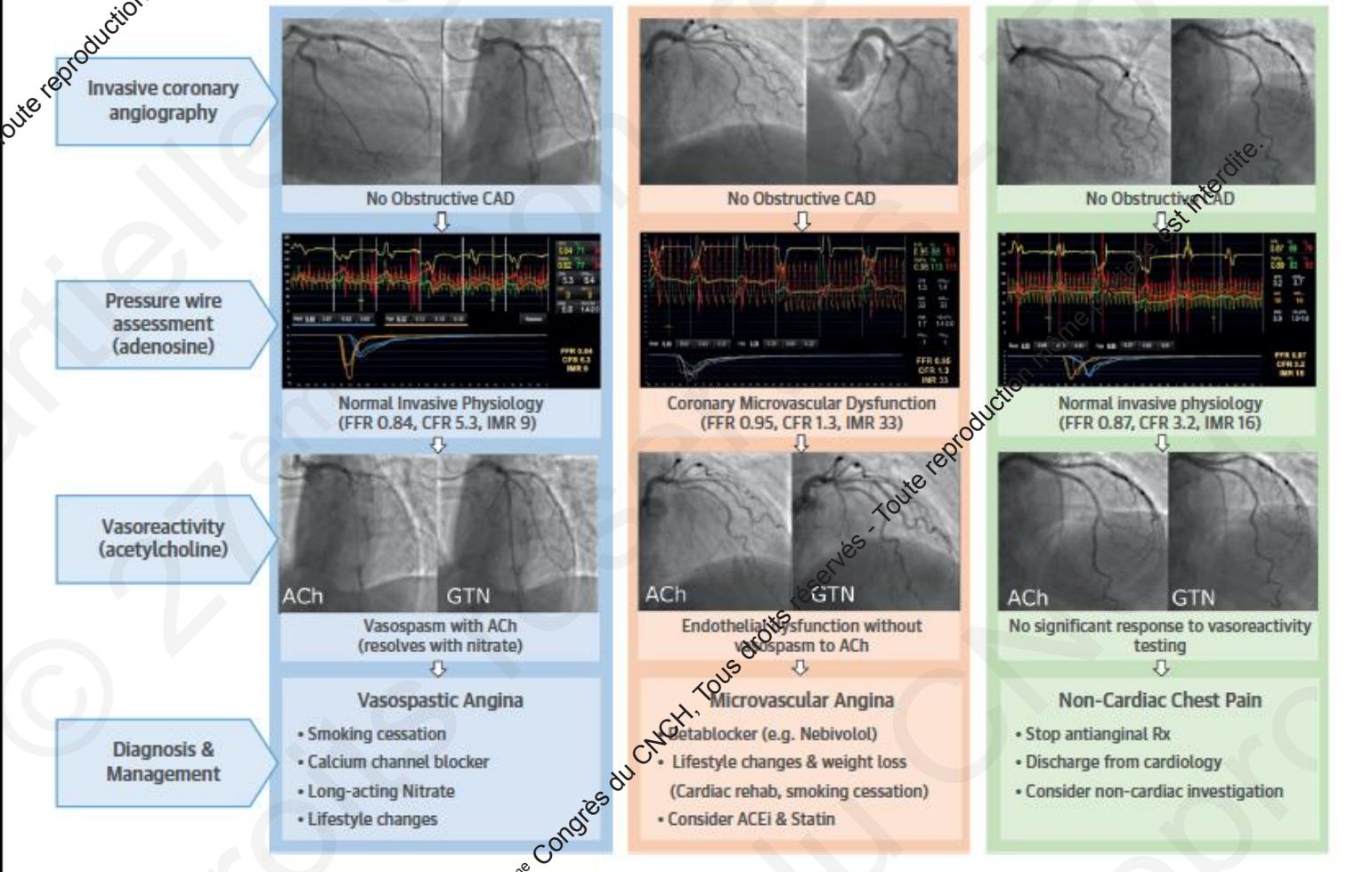
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ANOCA: Cormica study

n=76 intervention group
n=75 blinded control group

FIGURE 1 Stratified Medical Therapy Guided by an IDP in Patients With Angina but No Obstructive CAD



ANOCA

FIGURE 3 Primary Efficacy Outcome: Treatment Difference in the 6-Month SAQ Summary Score

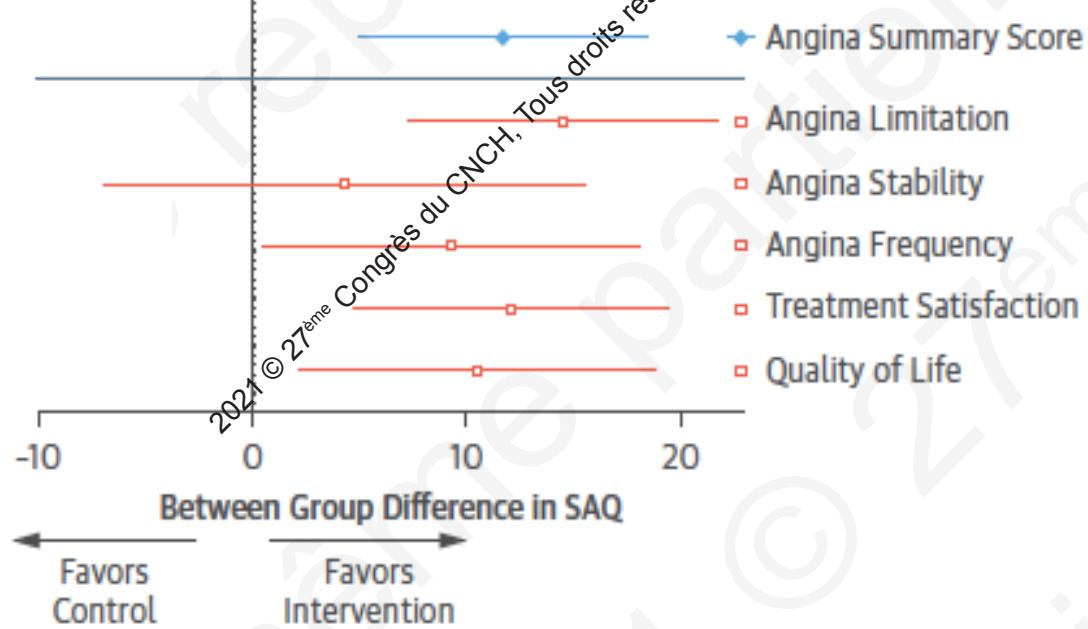
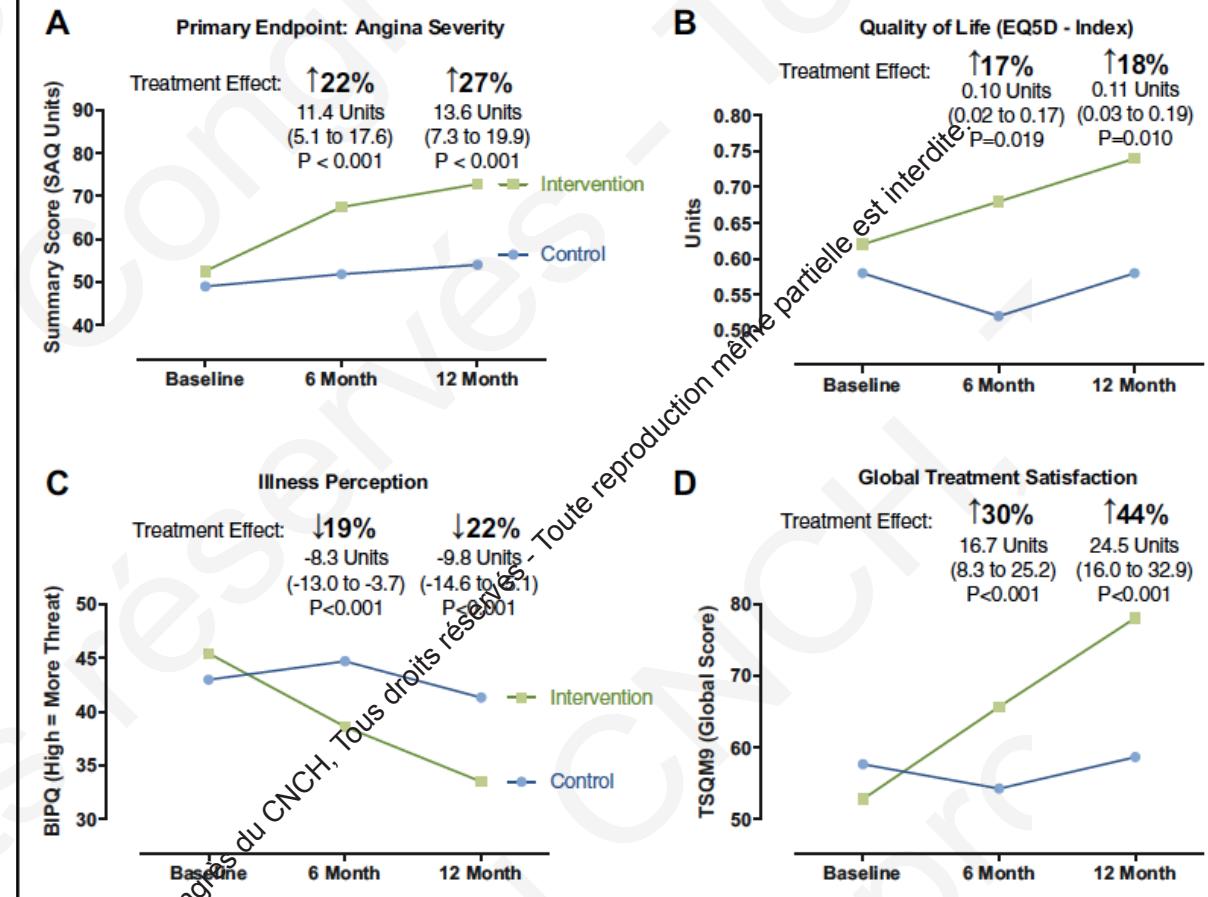


FIGURE 2 Primary Efficacy Endpoint: Quality of Life Mean Scores at Baseline and at 6 and 12 Months



INOCA

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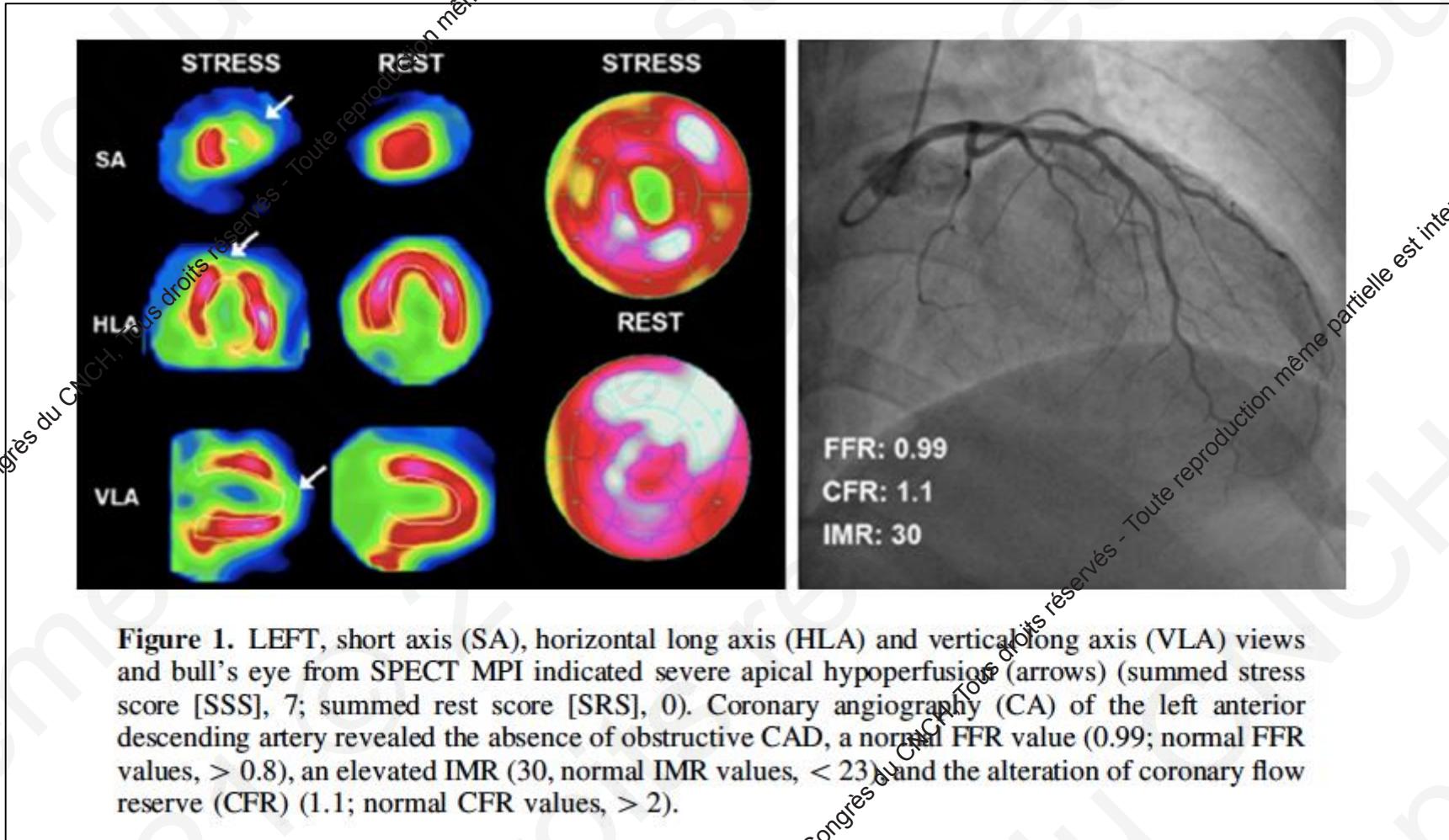


Figure 1. LEFT, short axis (SA), horizontal long axis (HLA) and vertical long axis (VLA) views and bull's eye from SPECT MPI indicated severe apical hypoperfusion (arrows) (summed stress score [SSS], 7; summed rest score [SRS], 0). Coronary angiography (CA) of the left anterior descending artery revealed the absence of obstructive CAD, a normal FFR value (0.99; normal FFR values, > 0.8), an elevated IMR (30, normal IMR values, < 23) and the alteration of coronary flow reserve (CFR) (1.1; normal CFR values, > 2).

An EAPCI Expert Consensus Document on Ischaemia with Non-Obstructive Coronary Arteries in Collaboration with European Society of Cardiology Working Group on Coronary Pathophysiology & Microcirculation Endorsed by Coronary Vasomotor Disorders International Study Group

SPECIAL ARTICLE

Coronary artery disease

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Step 1: Coronary angiography & LVEDP



Step 2: Diagnostic guidewire and Adenosine test

FFR + CFR + IMR*

FFR > 0.8
CFR ≥ 2.0
IMR < 25

FFR > 0.8
CFR < 2.0
IMR ≥ 25

No Coronary Microvascular Dysfunction Present

Coronary Microvascular Dysfunction Present

Step 3: Vasoactivity (Acetylcholine test)

- 1. No or <90% diameter reduction
- 2. No angina
- 3. No ischaemic ECG changes

- 1. ≥ 90% diameter reduction
- 2. + angina
- 3. + ischaemic ECG changes

- 1. No or <90% diameter reduction
- 2. No angina
- 3. No ischaemic ECG changes

- 1. No or <90% or ≥ 90% diameter reduction
- 2. + angina
- 3. + ischaemic ECG changes

Non-cardiac pain

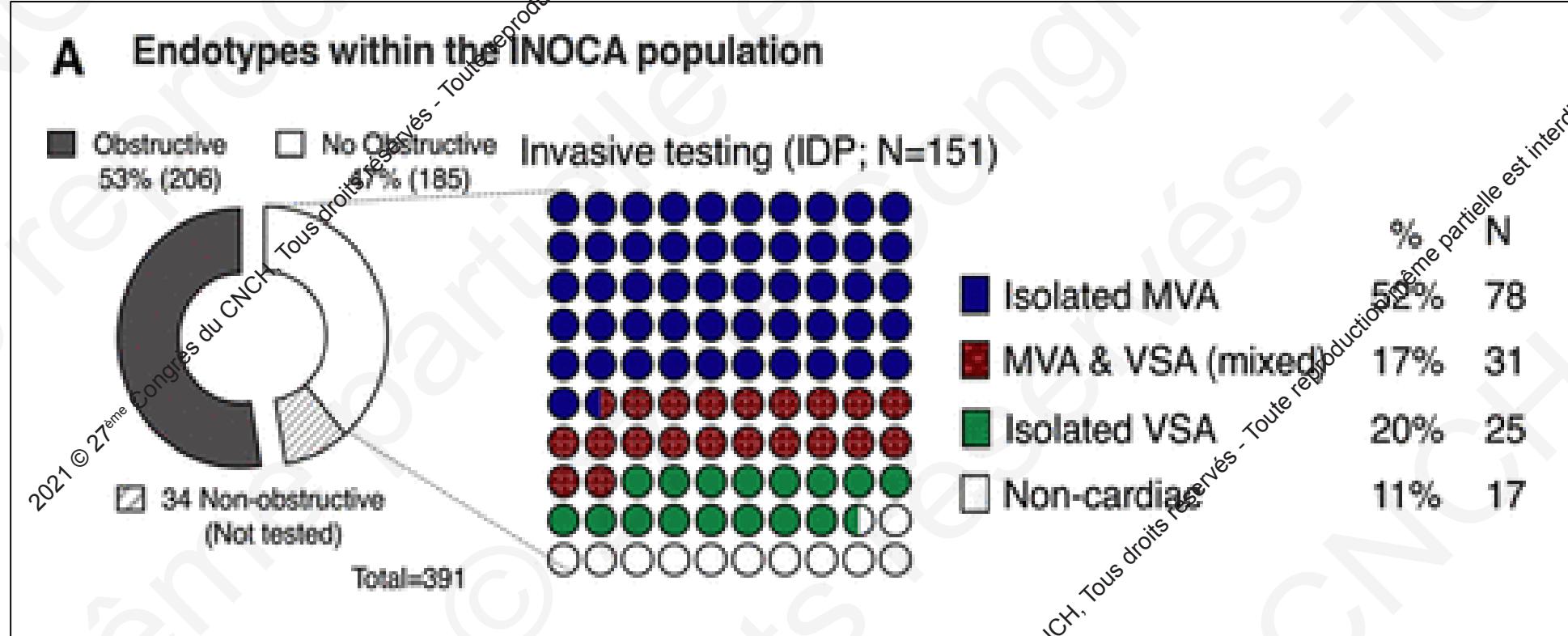
Epicardial Vasospastic Angina

Microvascular Angina

Microvascular And Epicardial Vasospastic Angina

INOCA ENDOTYPES

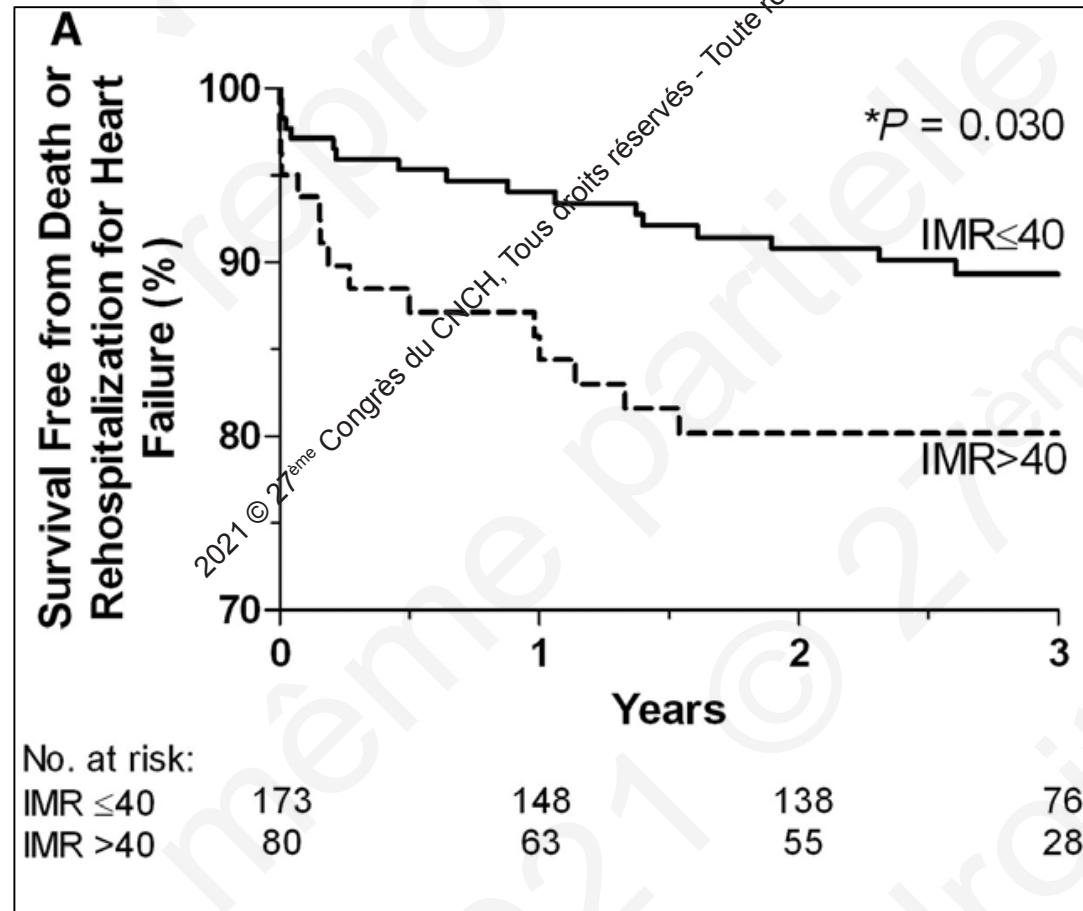
INOCA and ANOCA are very frequent in cath-lab



Prognosis: Microcirculation and PCI

253 patients, STEMI

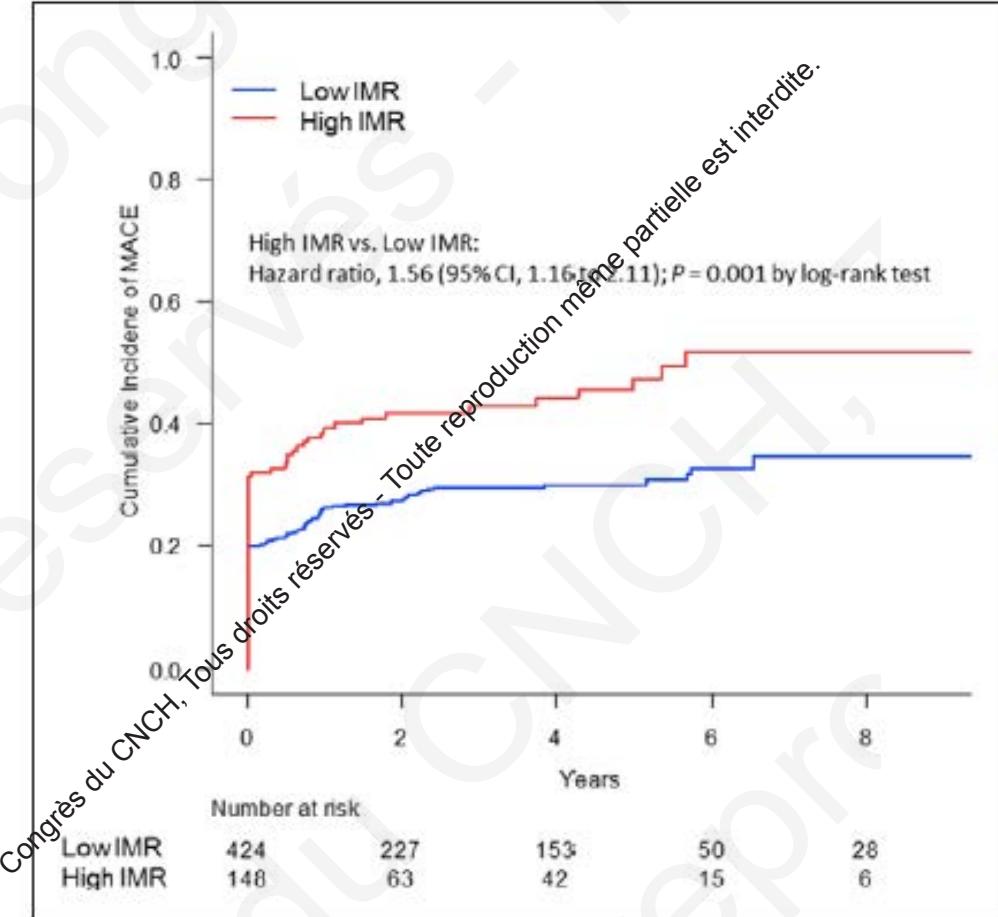
MACE: death or rehospitalization for heart failure.



Fearon WF et al. Circulation. 2013;127:2436-41

572 patients, CSS, IMR ≥ 25 , prospective observational study

MACE: Death, MI and target vessel revascularization



Nishi T et al. Circ Cardiovasc Interv. 2019;12:e007889

Prognosis: Microcirculation and PCI

253 patients, STEMI

MACE: death or rehospitalization for heart failure.

Table 2. Univariable and Multivariable Predictors of Death or Rehospitalization Resulting From Heart Failure ($P<0.1$)

	P Value	Hazard Ratio	95% CI
Univariable predictors			
Diabetes mellitus	<0.001	3.98	2.05–7.75
CFR <2	0.021	3.40	1.20–9.66
Hypertension	0.030	2.15	1.08–4.27
IMR >40	0.034	2.08	1.06–4.07
Age	0.058	1.03	1.00–1.06
FFR ≤0.8	0.072	2.15	0.93–4.94
TIMI myocardial perfusion grade <3	0.087	1.95	0.91–4.18
Multivariable predictors			
Diabetes mellitus	<0.001	4.44	2.22–8.88
FFR ≤0.8	0.008	3.24	1.35–7.76
IMR >40	0.026	2.23	1.10–4.49

Fearon WF et al. Circulation. 2013;127:2436-41

572 patients, CSS, IMR ≥ 25 , prospective observational study

MACE: Death, MI and target vessel revascularization

Table 2. Predictors of MACE

	HR	95% CI		P Value
		Lower	Upper	
High IMR	1.67	1.21	2.31	0.002
DM	1.49	0.99	2.04	0.012
Prior PCI	0.50	0.28	0.91	0.022
Prior MI	1.99	1.02	3.87	0.044
Stent length	1.02	1.00	1.04	0.053
DES use	0.67	0.42	1.05	0.080

Nishi T et al. Circ Cardiovasc Interv. 2019;12:e007889

Prognosis

STRATIFIED MEDICINE

Stratified medicine is the identification of patient subgroups (or endotypes) within a heterogeneous population, these being distinguishable by disease severity and potential for response to therapy.

A **Theragnostic biomarker** is a metric that predicts therapeutic response.

Potential role of IMR as a theragnostic biomarker to guide stratified medicine in acute and chronic coronary syndrome

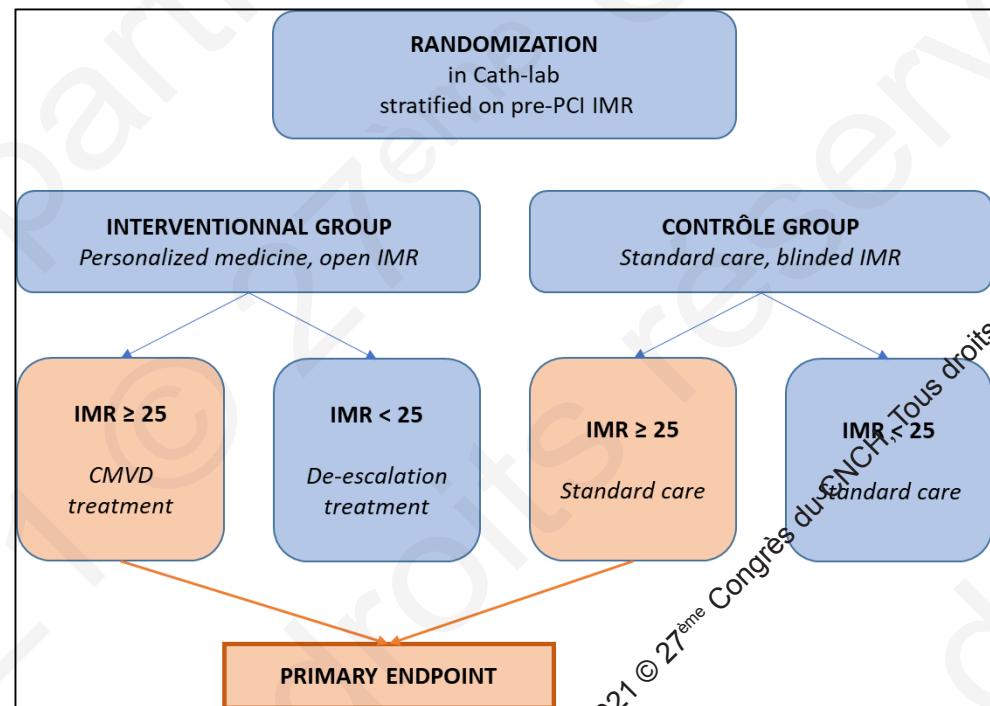
Future: Randomized studies

Acute coronary syndrome

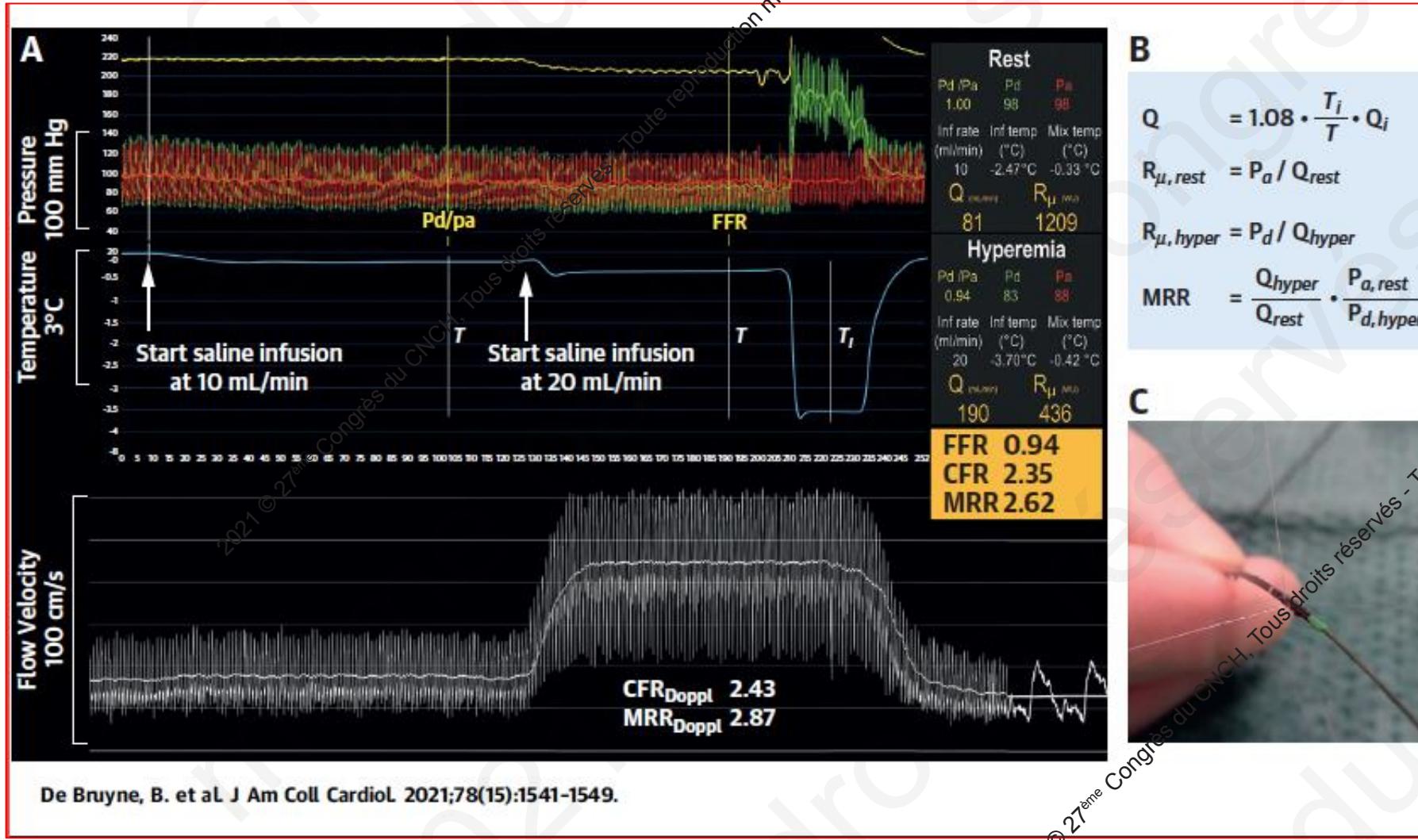
A Study of Low-dose Intracoronary Thrombolytic Therapy in STEMI (Heart Attack) Patients. (RESTORE-MI)
NCT03998319. 506 patients. STEMI IMR ≥ 32 low, or very low dose tenecteplase vs placebo- Australia

Chronic coronary syndrome

Personalized Medicine Using Coronary Microvascular Function Measured in Patient with Percutaneous Coronary Intervention in Angina. (DECISIONING) – France



Future: More precise or more simple ?



Microvascular resistance reserve: independent of autoregulation and myocardial mass, and based on operator-independent measurements of absolute values of coronary flow and pressure

Conclusion

- Microcirculation dysfunction must be explored in ANOCA and INOCA patients to improve their symptoms and quality of life.
- In other cases, especially during PCI: science is in progress