ČAIK ČKS

CHKS ve světle nových evropských doporučení

INOCA/ANOCA v denní praxi

Petr Kala

Interní kardiologická klinika FN Brno a LF MU

5.5.2025

Terminologie

- ANOCA = Angina with nonobstructive coronary arteries
- INOCA = Ischemia with nonobstructive coronary arteries
- MINOCA = Myocardial infarction with nonobstructive coronary arteries
- **Neobstruktivní koronární postižení = diametr stenózy < 50% (FFR > 0,80, klidové indexy > 0,89)**

Jedná se o PRACOVNÍ DIAGNÓZY vyžadující upřesnění a došetření.

INOCA/ANOCA

- Pacienti (**2/3 ženy**) s chronickou stabilní AP (minimálně >3 měsíce, častěji roky) **bez obstruktivního koronárního postižení**
- Většinou mají **typickou AP (62%)**, 38% netypickou
- Mají **vyloučenou jinou příčinu** bolestí na hrudi - AP (plicní hypertenze, HKMP, chlopenní postižení, perikarditida, afekce mediastina..)
- Většinou mají minimálně jeden, ale **často i více zátěžových testů** a často i **více než 1x SKG**, podobně jako časté **návštěvy UP**
- Zkouší se **různá farmakoterapie**, režimová opatření
- Cítí se špatně…i jako simulanti…

INOCA Endotypy

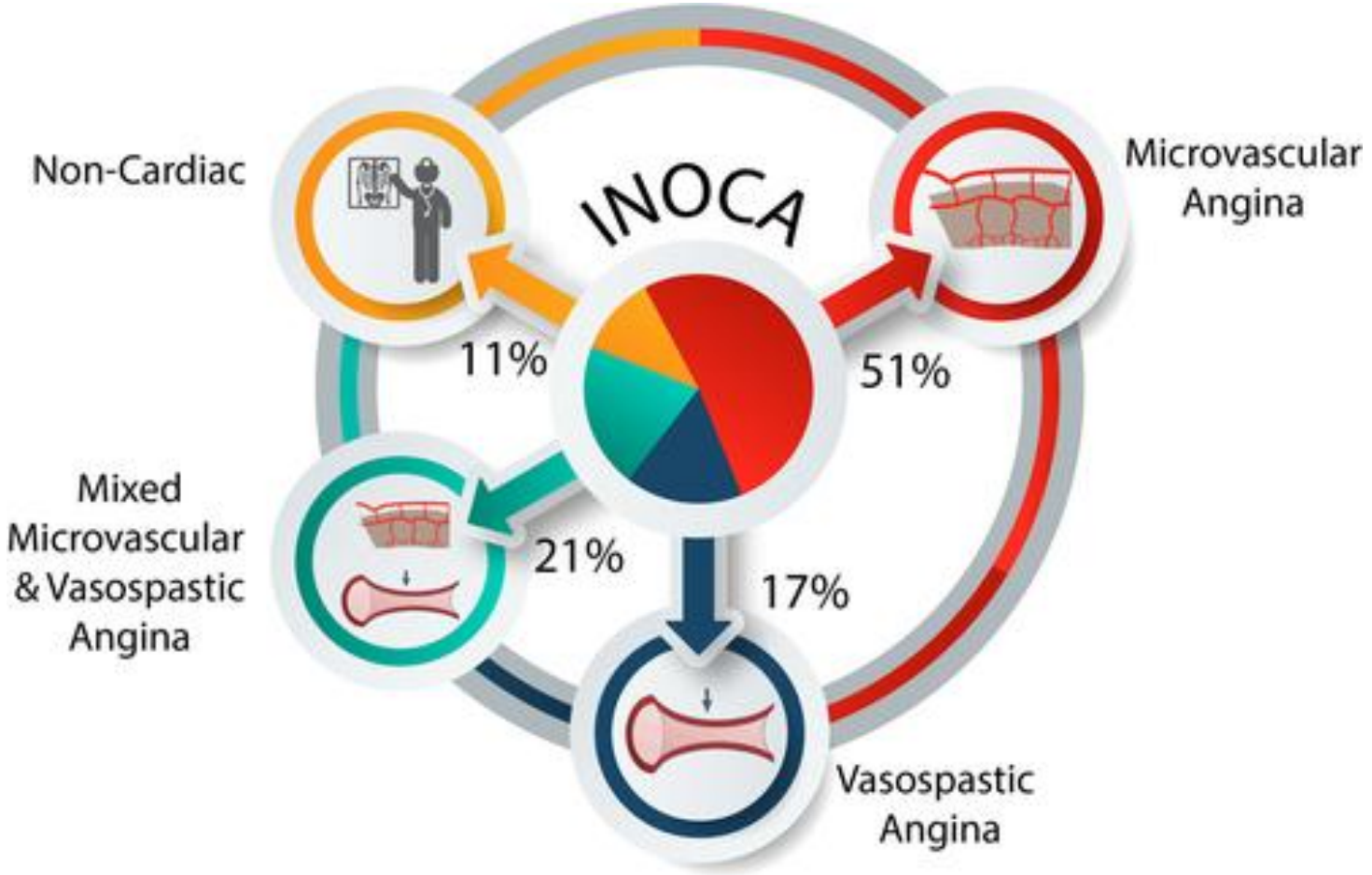
AP + Neobstruktivní koronární postižení

- Mikrovaskulární AP (funkční/strukturální)
- Vasospastická AP (epikardiálních tepen)
- Kombinace MVA/VSA
- Nekardiální příčiny
- Svalový můstek (the forgotten endotype)

Ford et al. Circ Cardiovasc Interv 2019;12:e008126, Lee, Tremmel, et al. Circulation 2015
Pargaonkar, Tremmel, et al. EuroIntervention 2021

INOCA Endotypy

AP + Neobstruktivní koronární postižení



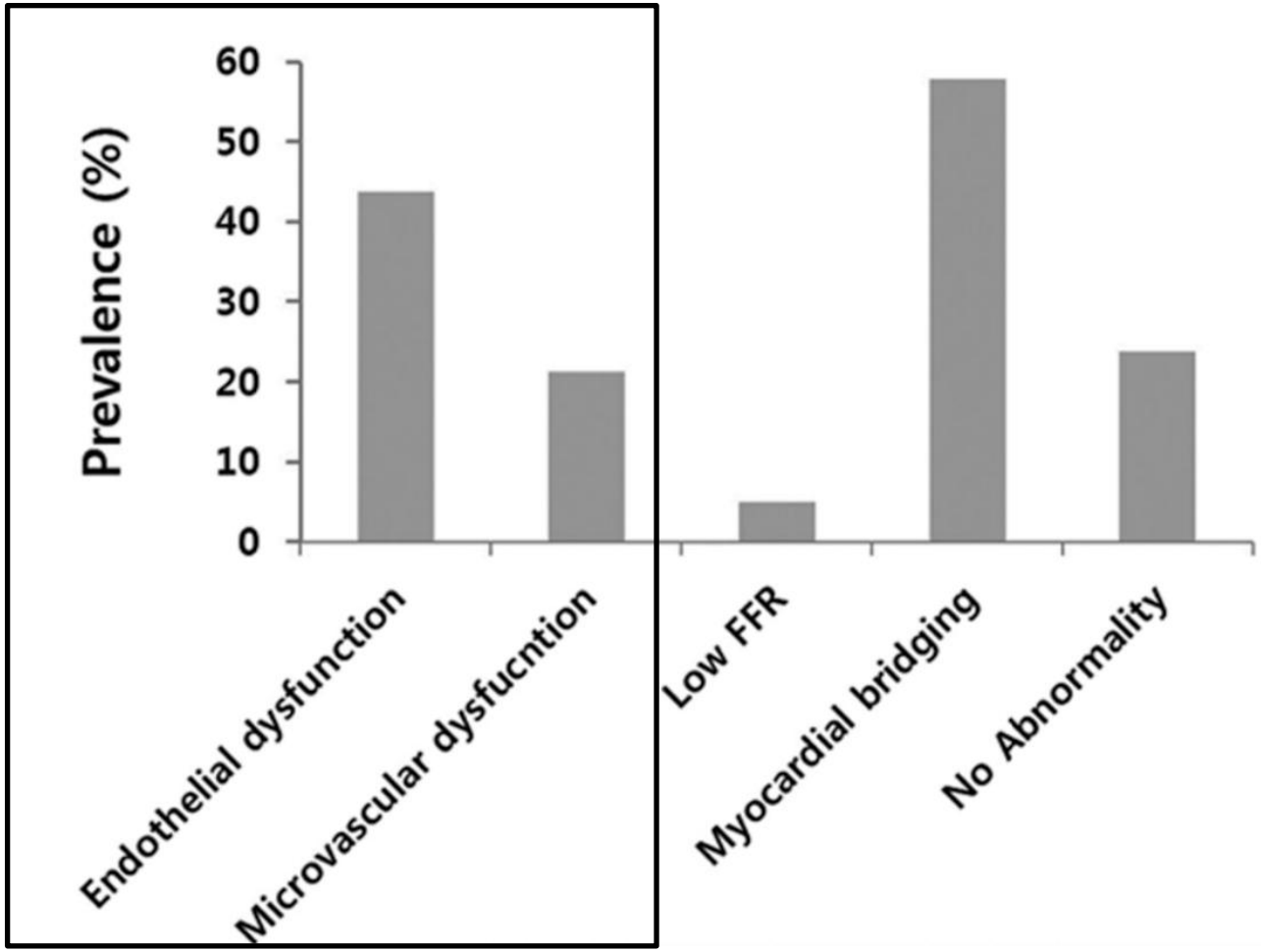
Ford et al. Circ Cardiovasc Interv 2019;12:e008126, Lee, Tremmel, et al. Circulation 2015
Pargaonkar, Tremmel, et al. EuroIntervention 2021

Diagnostické testy myokardiální ischemie - od neinvazivních k invazivním

- ✓PET - myocardial blood flow (MBF)
- ✓MR - myocardial perfusion reserve index (MPRI)
- ✓Kontrastní echokardiografie + myokadiální strain
- ✓SPECT

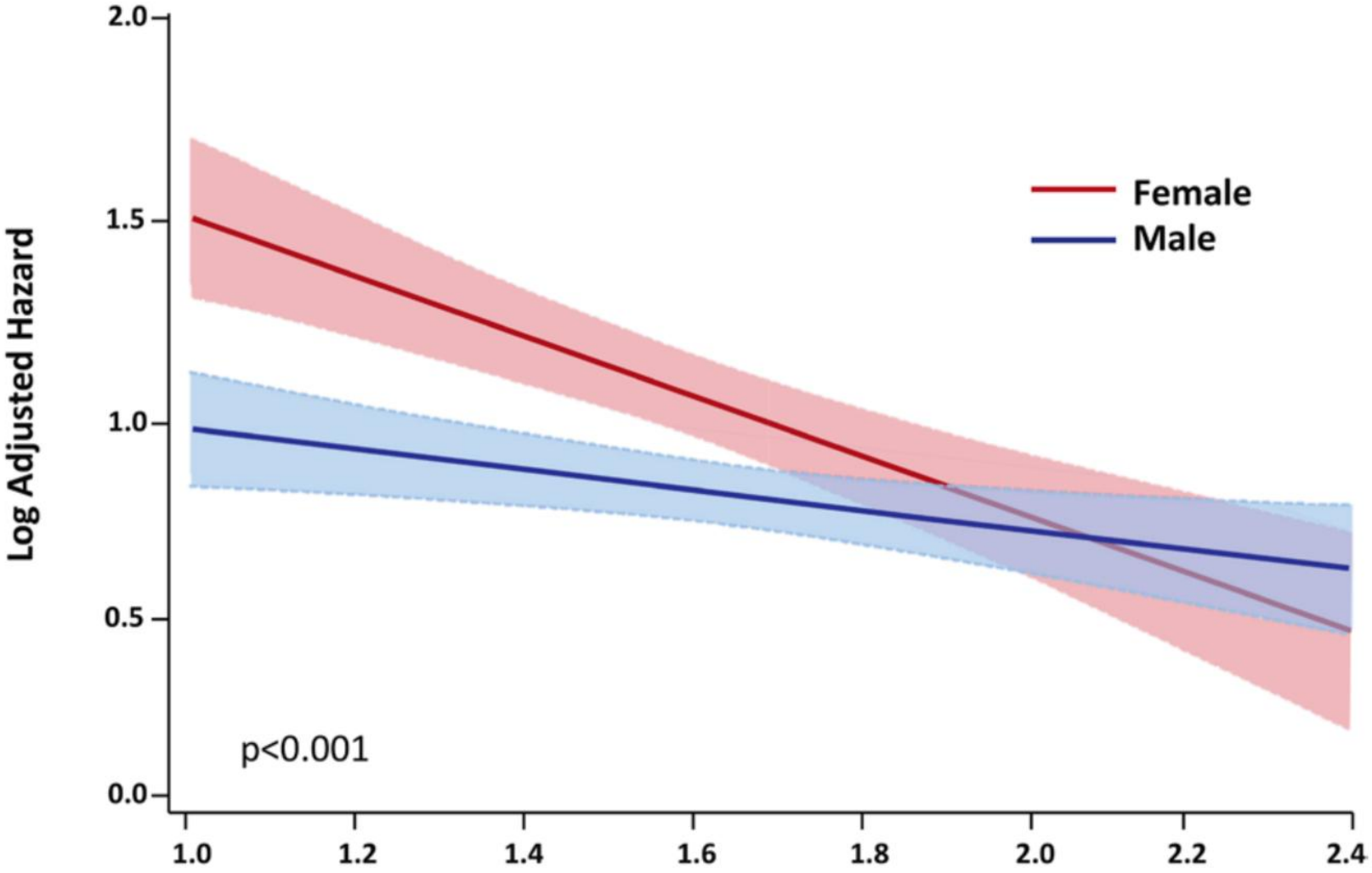
- ✓**Testování mikrovaskulární dysfunkce INVAZIVNÍ**

Invazivní posouzení INOCA Stanford (N=139)



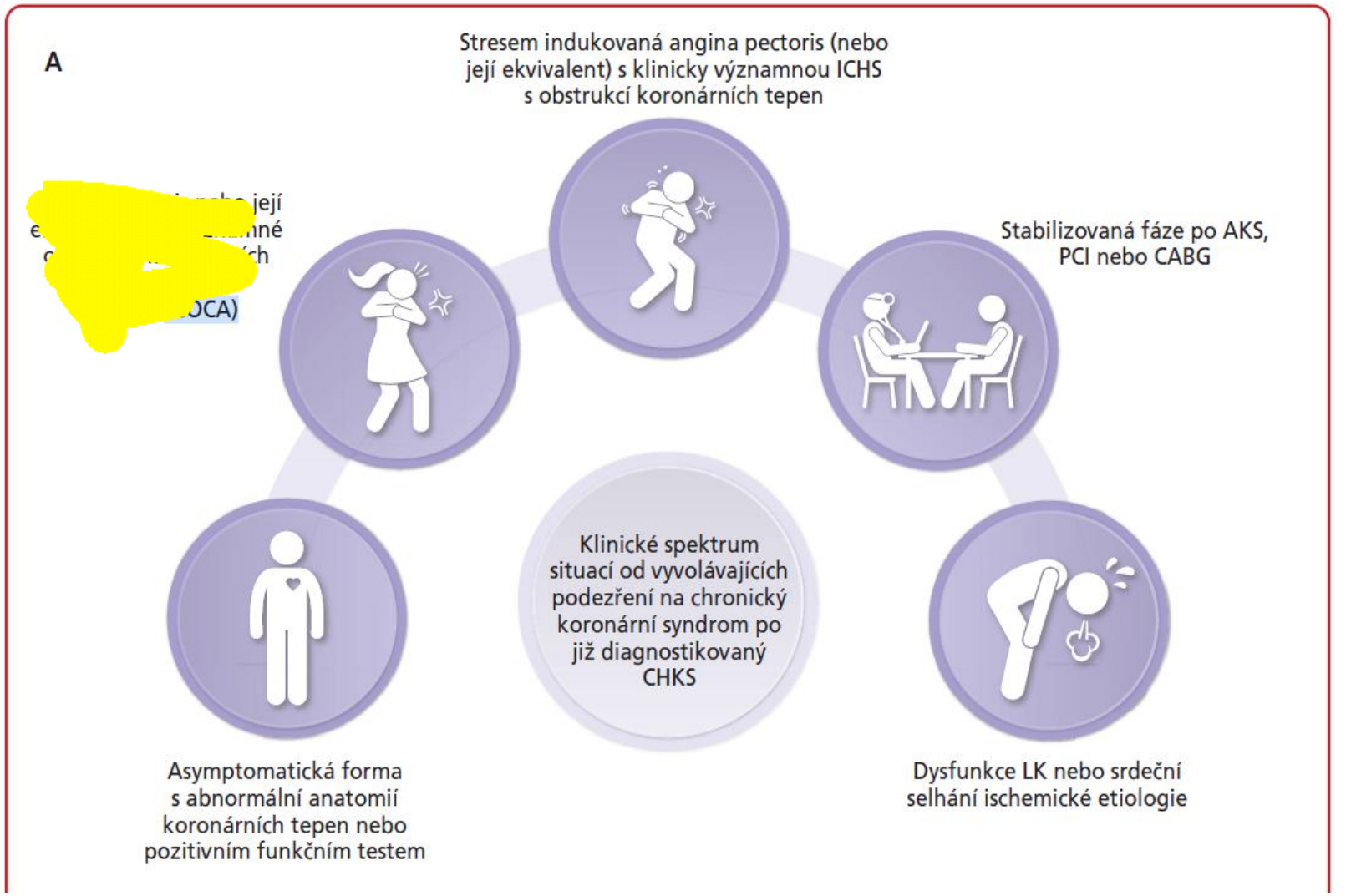
Lee et al. Circulation. 2015

Nízká hodnota CFR = vyšší KV riziko



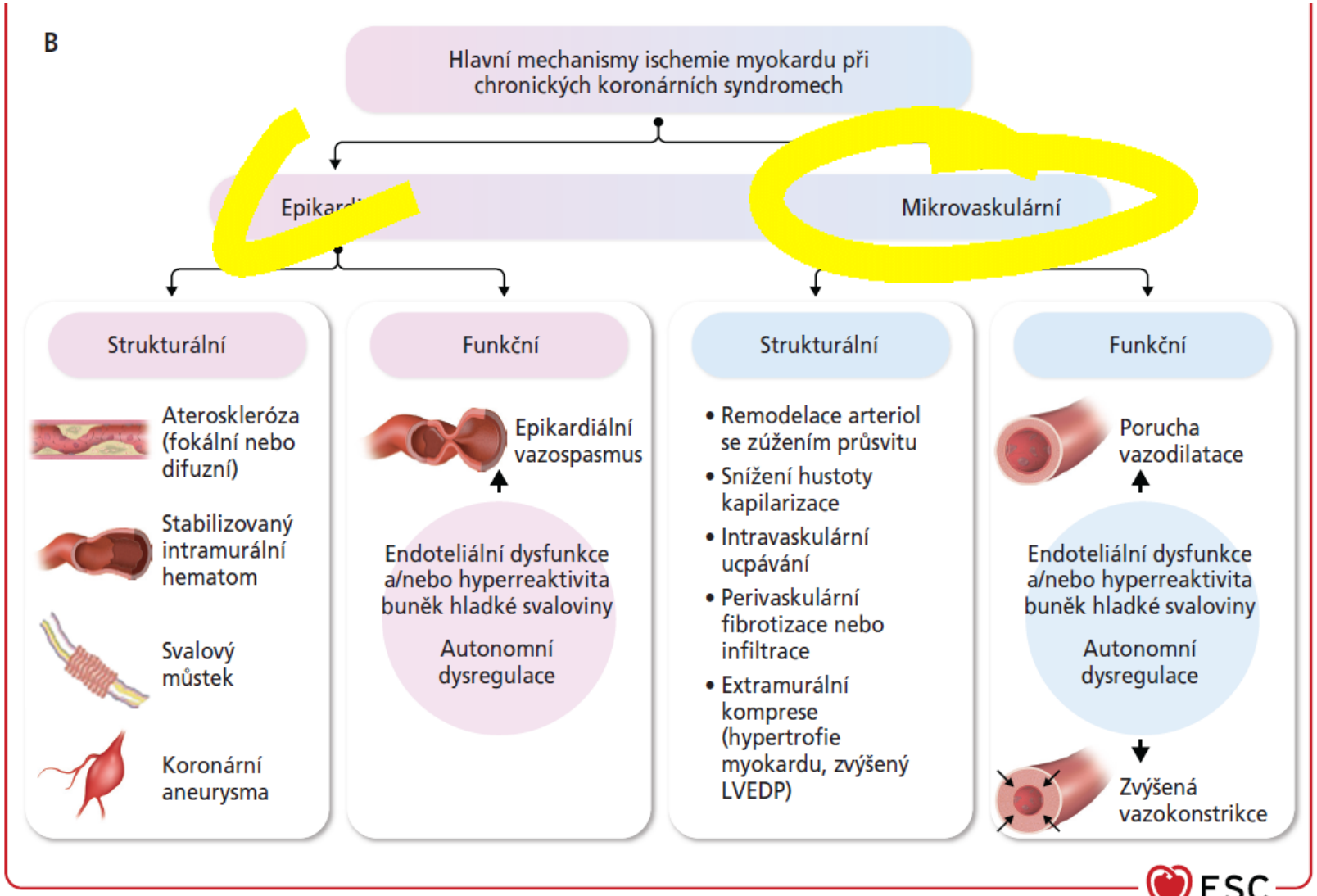
Taqueti et al. Circulation. 2017

ANOCA/INOCA



Kala P, Pudil R, Varvařovský I, Skalická H. Doporučení ESC pro léčbu chronických koronárních syndromů 2024. Vrints C, Andreotti F, Koskinas KC, Rossello X, Adamo M, Ainslie J, Banning AP, Budaj A, Buechel RR, Chiariello GA, Chieffo A, Christodorescu RM, Deaton C, Doenst T, Jones HW, Kunadian V, Mehilli J, Milojevic M, Piek JJ, Pugliese F, Rubboli A, Semb AG, Senior R, ten Berg JM, Van Belle E, Van Craenenbroeck EM, Vidal-Perez R, Winther S, ESC Scientific Document Group. Překlad zkráceného dokumentu vypracovaný ČAIK ČKS. Cor Vasa 2025;67:230–294

ANOCA/INOCA



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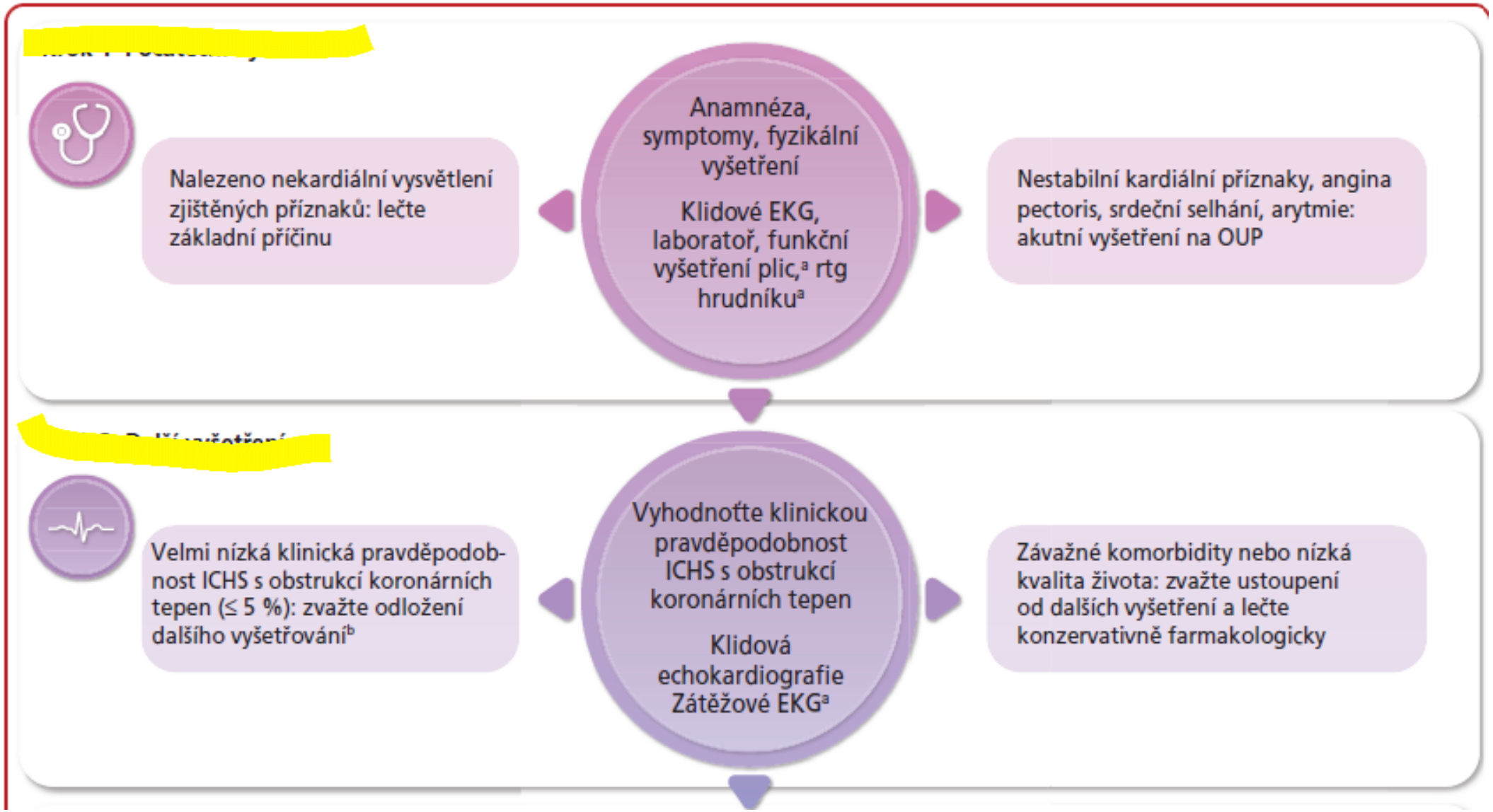

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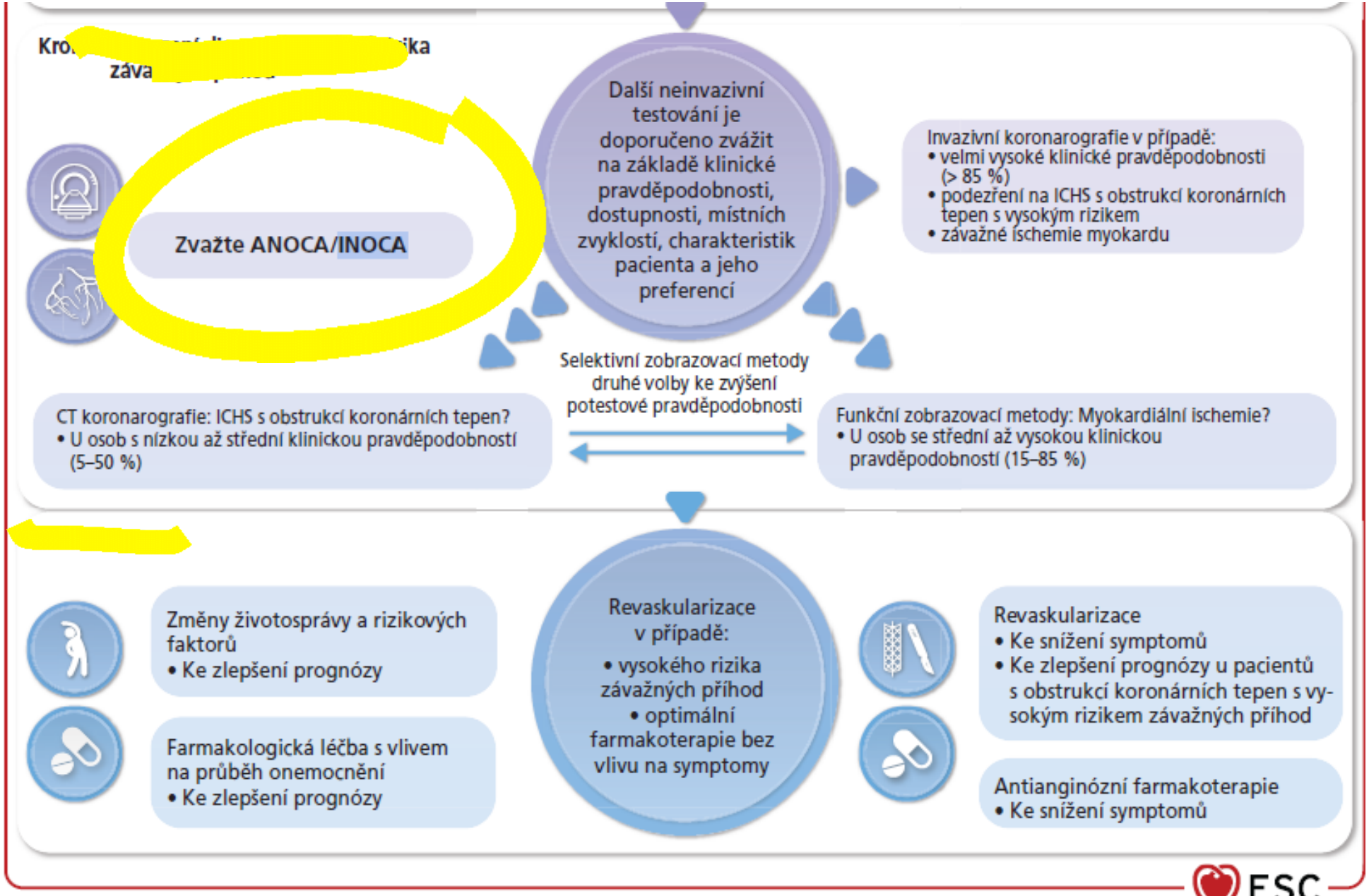

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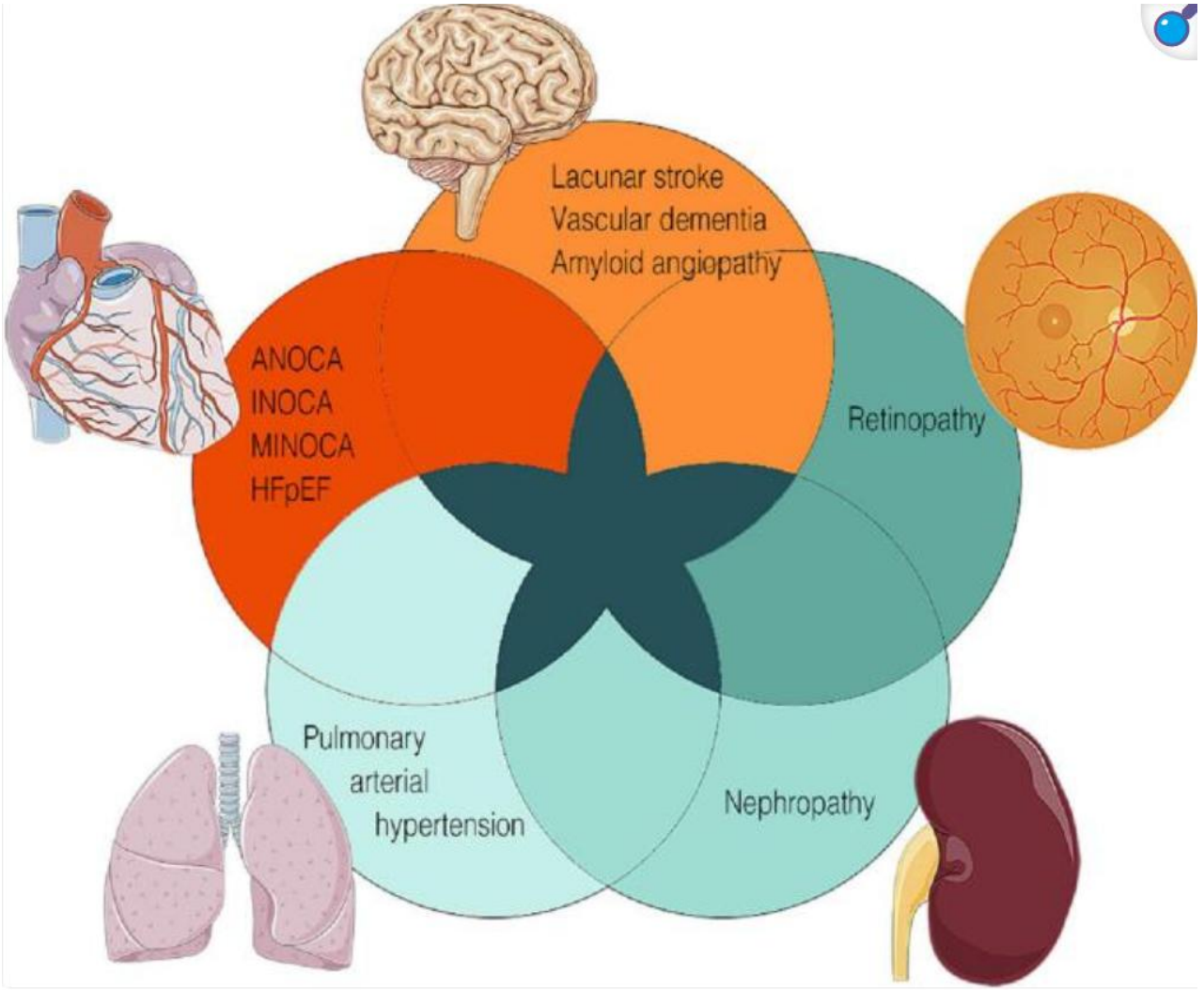
ESC Guidelines ChKS 2024

Recurrent or refractory angina/ischaemia		
In patients with refractory angina leading to poor quality of life and with documented or suspected ANOCA/INOCA, invasive coronary functional testing is recommended to define ANOCA/INOCA endotypes and appropriate treatment, considering patient choices and preferences.	I	B

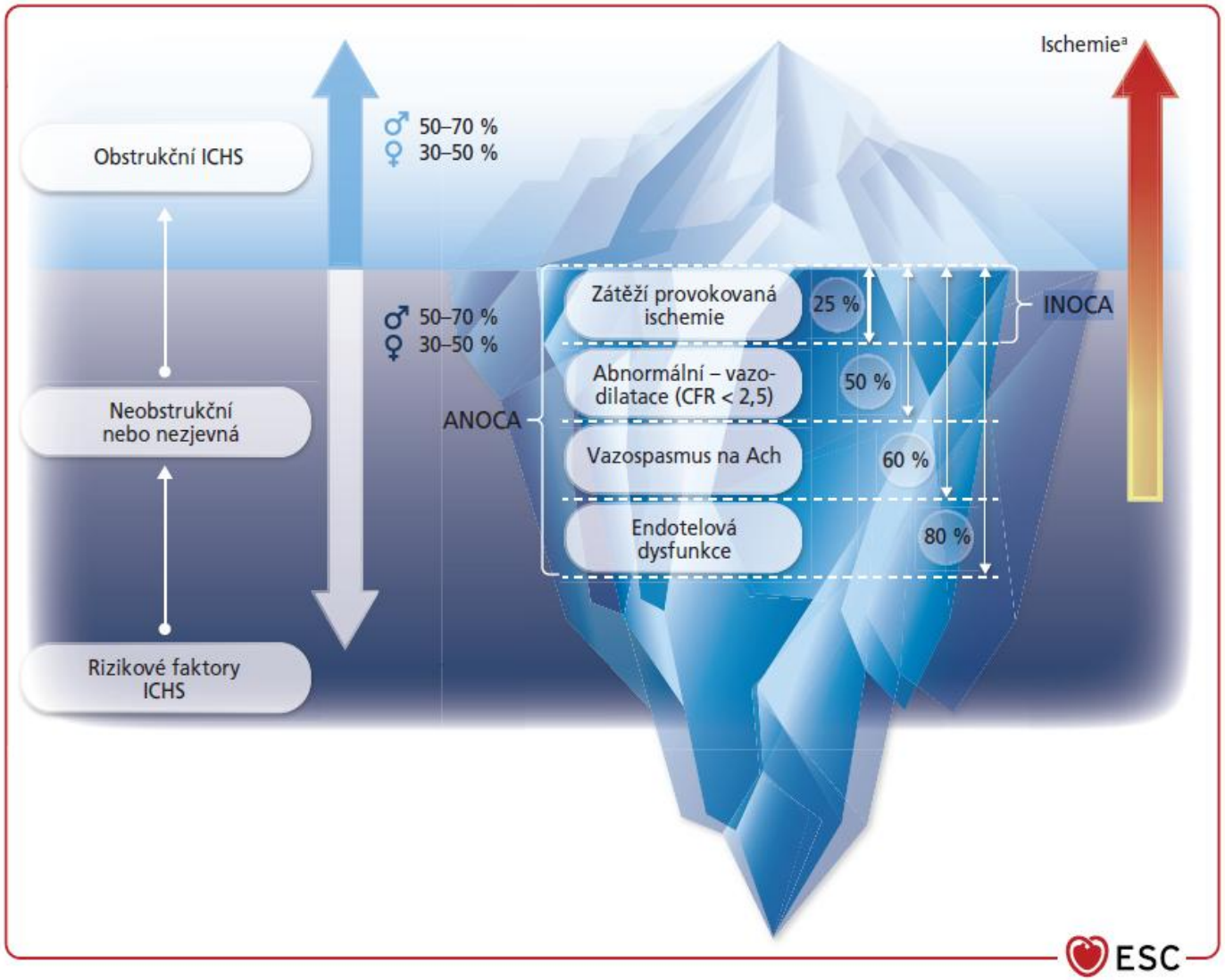
..u pacientů s ANOCA/INOCA a opakovanými obtížemi je indikováno invazivní funkční testování koronárních tepen

Multiorgánové postižení mikrocirkulace



Pepine CJ. Am Heart J Plus 2023, Jan 25;26:100260

ANOCA/INOCA



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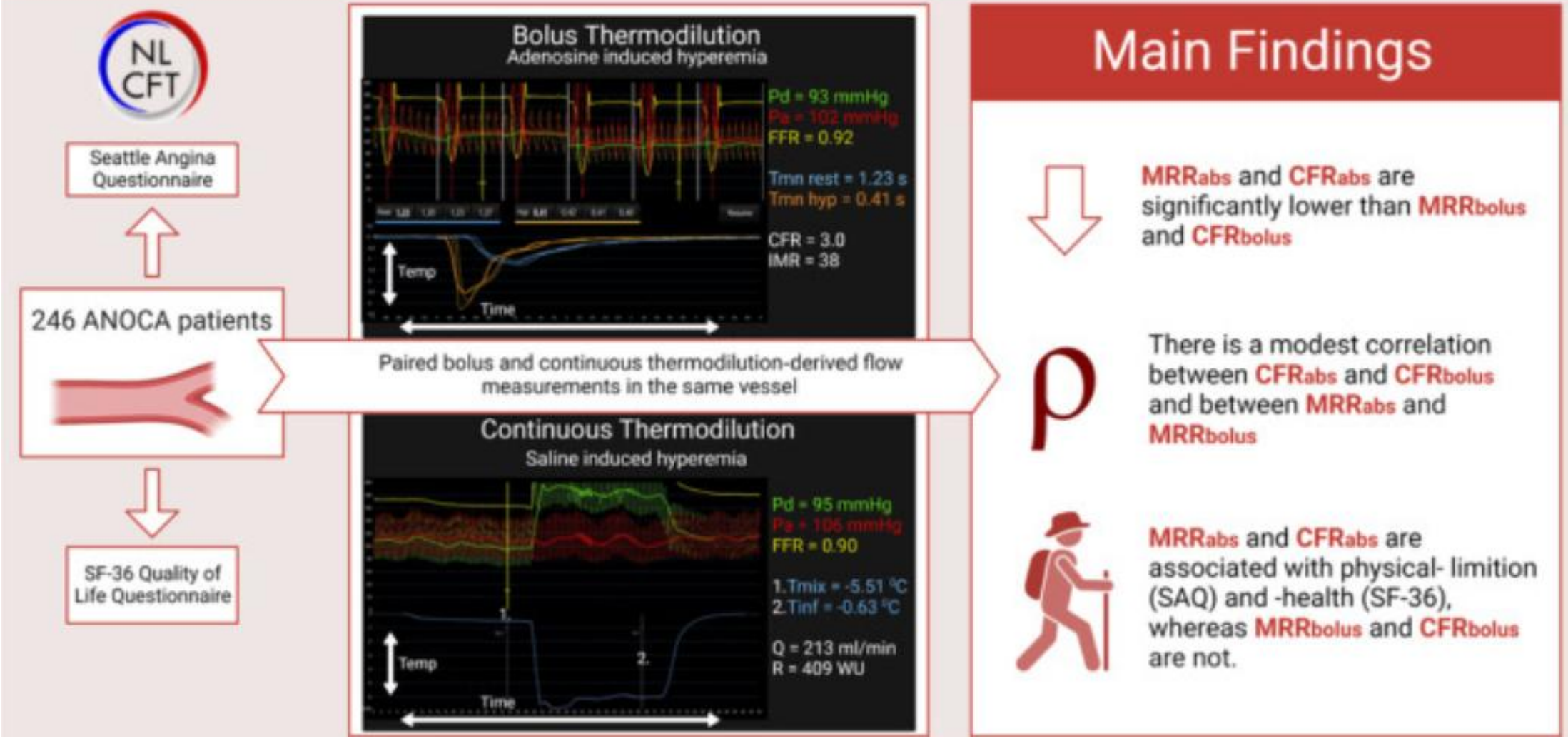
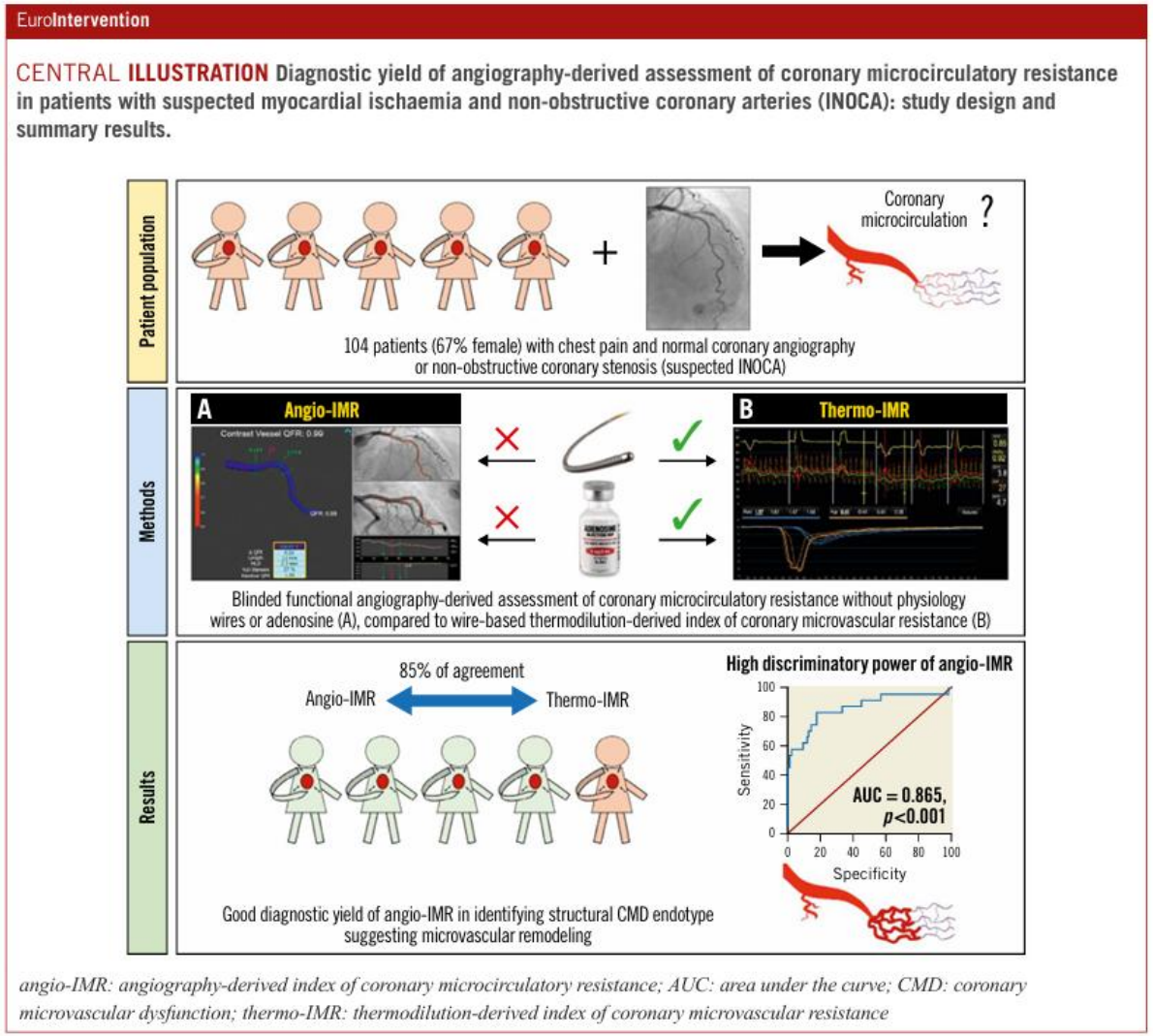
Bolus versus continuous thermodilution-derived parameters of microvascular dysfunction



Jansen TPJ et al. J Am Heart Assoc. 2023 Aug 15; 12(16): e030480.

ANOCA/INOCA – vFFR/QFR + Angio-IMR

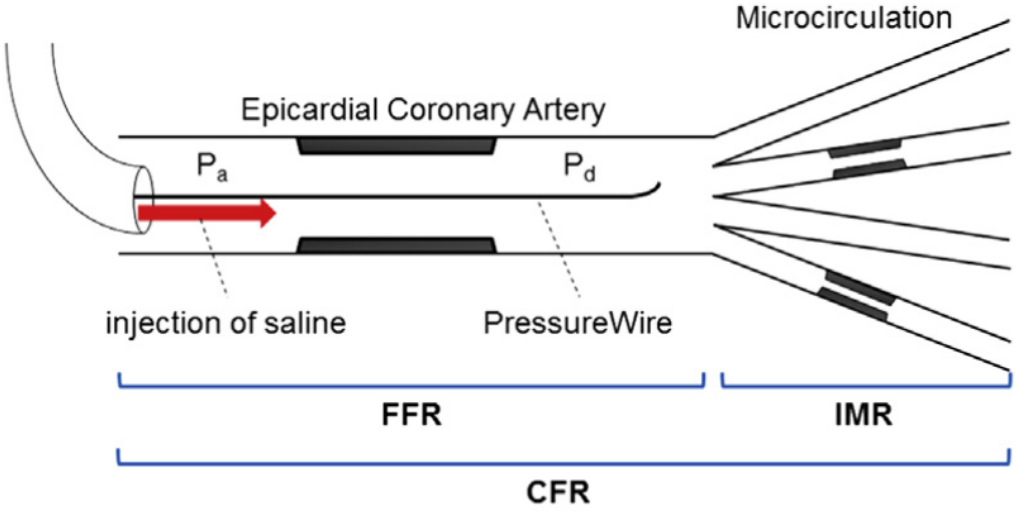


Mejía-Rentería H et al. EuroIntervention 2023;18:e1348-e1356

Invazivní diagnostické testy
Posouzení mikrocirkulace

- ✓ **CFR – koronární průtoková rezerva** (Coronary flow reserve) – měřeno termodilučně, dříve také pomocí Doppleru
- ✓ **IMR – index mikrovaskulární rezistence** – termodiluce, event. hyperemická microvaskulární rezistence (HMR - Doppler)
- ✓ **MRR – rezerva rezistence mikrocirkulace**
- ✓ Adenosine (+/- acetylcholine)
- ✓ **FFR** normální/nevýznamné

IMR >25
CFR < 2,0 nebo 2,5
MRR <2,2



ESC European Society of Cardiology
European Heart Journal (2020) 41, 3504–3520
doi:10.1093/eurheartj/ehaa503

SPECIAL ARTICLE
Ischaemic heart disease

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

Vijay Kunadian (UK, Document Chair)[1*†], Alaide Chieffo (Italy, Document

Table 1 Diagnostic criteria for microvascular angina

Criteria	Evidence	Diagnostic parameters
1	Symptoms of myocardial ischaemia[a]	Effort or rest angina Exertional dyspnoea
2	Absence of obstructive CAD (<50% diameter reduction or FFR >0.80)	Coronary CTA Invasive coronary angiography
3	Objective evidence of myocardial ischaemia[b]	Presence of reversible defect, abnormality or flow reserve on a functional imaging test
4	Evidence of impaired coronary microvascular function	Impaired coronary flow reserve (cut-off <2.0), invasive or noninvasively determined Coronary microvascular spasm, defined as reproduction of symptoms, ischaemic ECG shifts but no epicardial spasm during acetylcholine testing Abnormal coronary microvascular resistance indices (e.g. IMR ≥25)

Definitive microvascular angina is only diagnosed if criterias 1, 2, 3 and 4 are present.

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Diagnosis	Treatment	Mechanisms of effect
MVA	Beta-blockers (Nebivolol 2.5-10 mg daily)	– ↓ Myocardial oxygen consumption – Antioxidant properties
	Calcium channel blockers (Amlodipine 10 mg daily)	– Vascular smooth muscle relaxation – ↓ Myocardial oxygen consumption
	Ranolazine (375-750 mg twice daily or 500 mg-1 g twice daily in the USA)	– Improves microvascular perfusion reserve index in patients with MVA and reduced CFR
	Trimetazidine (35 mg twice daily)	– Increases cell tolerance to ischaemia by maintaining cellular homeostasis
	ACE inhibitors (Ramipril 2.5 -10 mg), ARBs	– Improve CFR – ↓ Workload – May improve small vessel remodelling

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VSA	Calcium channel blockers (Amlodipine 10 mg or Verapamil 240 mg SR or Diltiazem 90 mg twice daily or 120-360 mg single or divided doses)	– ↓ Spontaneous and inducible coronary spasm via vascular smooth muscle relaxation – ↓ Oxygen demand
	Nitrates (Isosorbide mononitrate XL 30 mg)	– ↓ Spontaneous and inducible coronary spasm via large epicardial vasodilation – ↓ Oxygen demand
	Nicorandil (10-20 mg twice daily)	– Potassium channel activator with coronary microvascular dilatory effect

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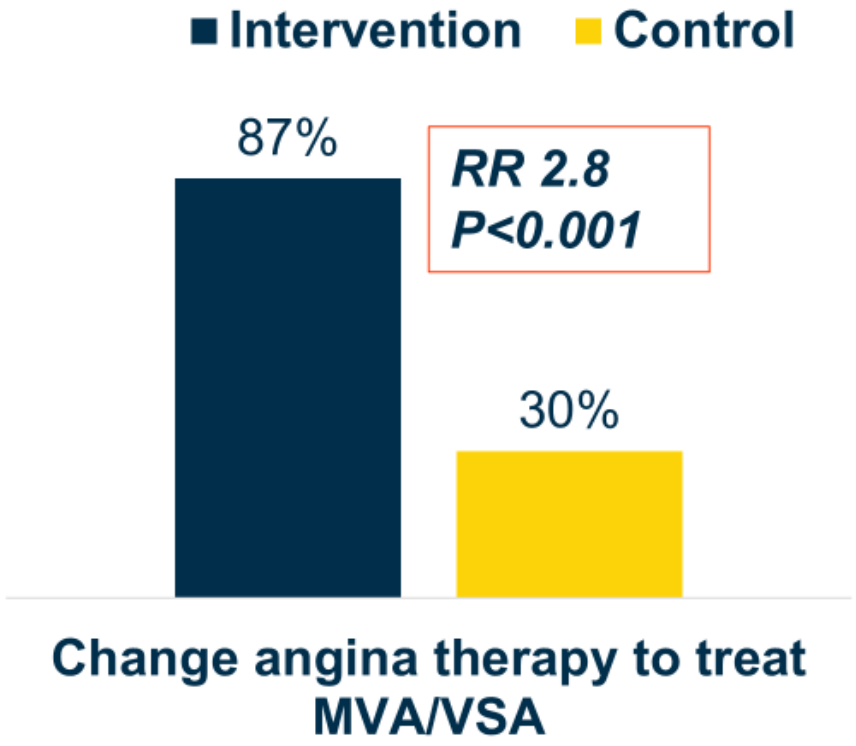
Vijay Kunadian (UK, Document Chair)[1*†], Alaide Chieffo (Italy, Document

Both MVA + VSA	Calcium channel blockers (Amlodipine 10 mg or Verapamil 240 mg SR or Diltiazem 90 mg twice daily or 120-360 mg single or divided doses)	– Vascular smooth muscle relaxation – ↓ Myocardial oxygen consumption
	Nicorandil (10-20 mg twice daily)	– Potassium channel activator with coronary microvascular dilatory effect
	Trimetazidine (35 mg twice daily)	– Increases cell tolerance to ischaemia by maintaining cellular homeostasis
	ACE inhibitors (Ramipril 2.5-10 mg), ARBs	– Improve CFR – ↓ Workload – May improve small vessel remodelling
	Statins (Rosuvastatin 10-20 mg)	– Improve coronary endothelial function – Pleiotropic effects including reduced vascular inflammation

Má invazivní testování smysl? Jaké jsou terapeutické výstupy?

2 Treatment Guided by Invasive Physiology (INOCA)

Does IDP lead to Change in Rx?

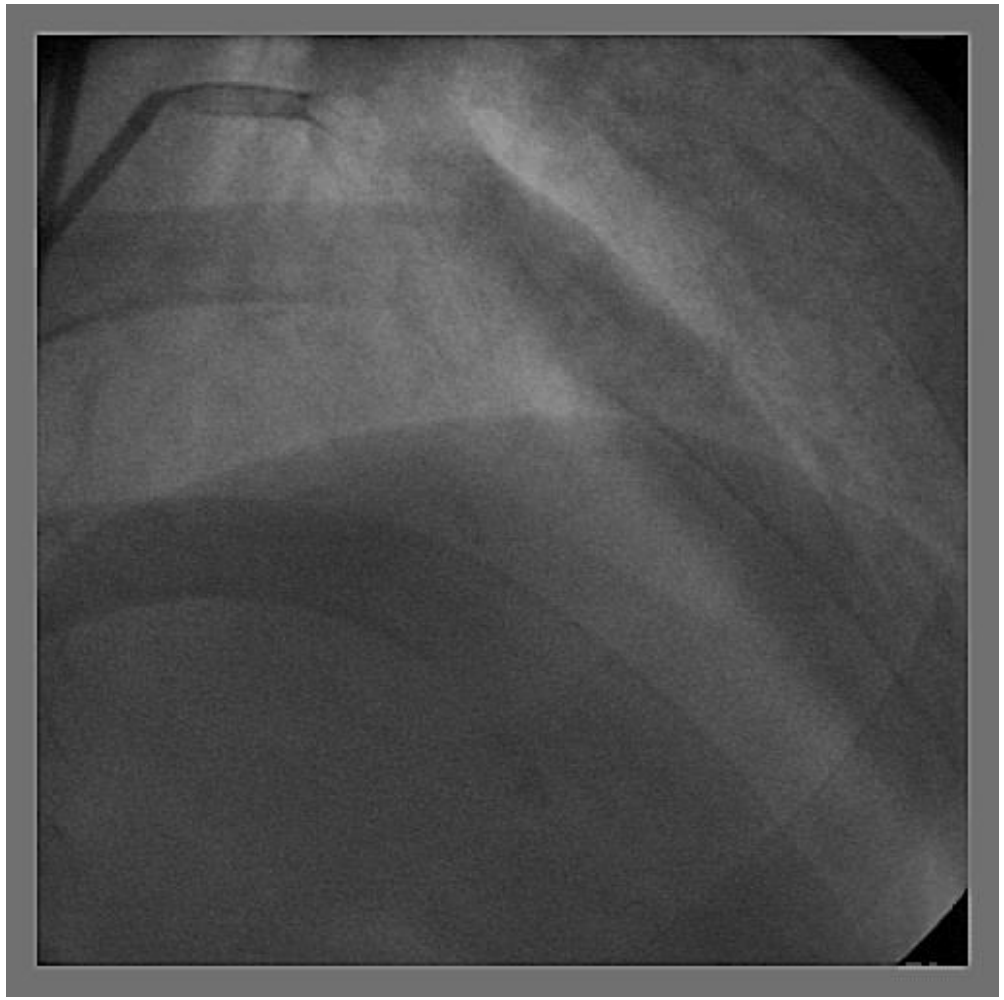


6 Months Rx

	Intervention	Control	P-value
CCB	38 (51%)	16 (21%)	<0.001
ISMN	29 (39%)	18 (24%)	0.054
Nicorandil	11 (15%)	6 (8%)	0.209
ACE/ARB	44 (59%)	28 (37%)	0.009
Statin	66 (88%)	41 (54%)	0.001

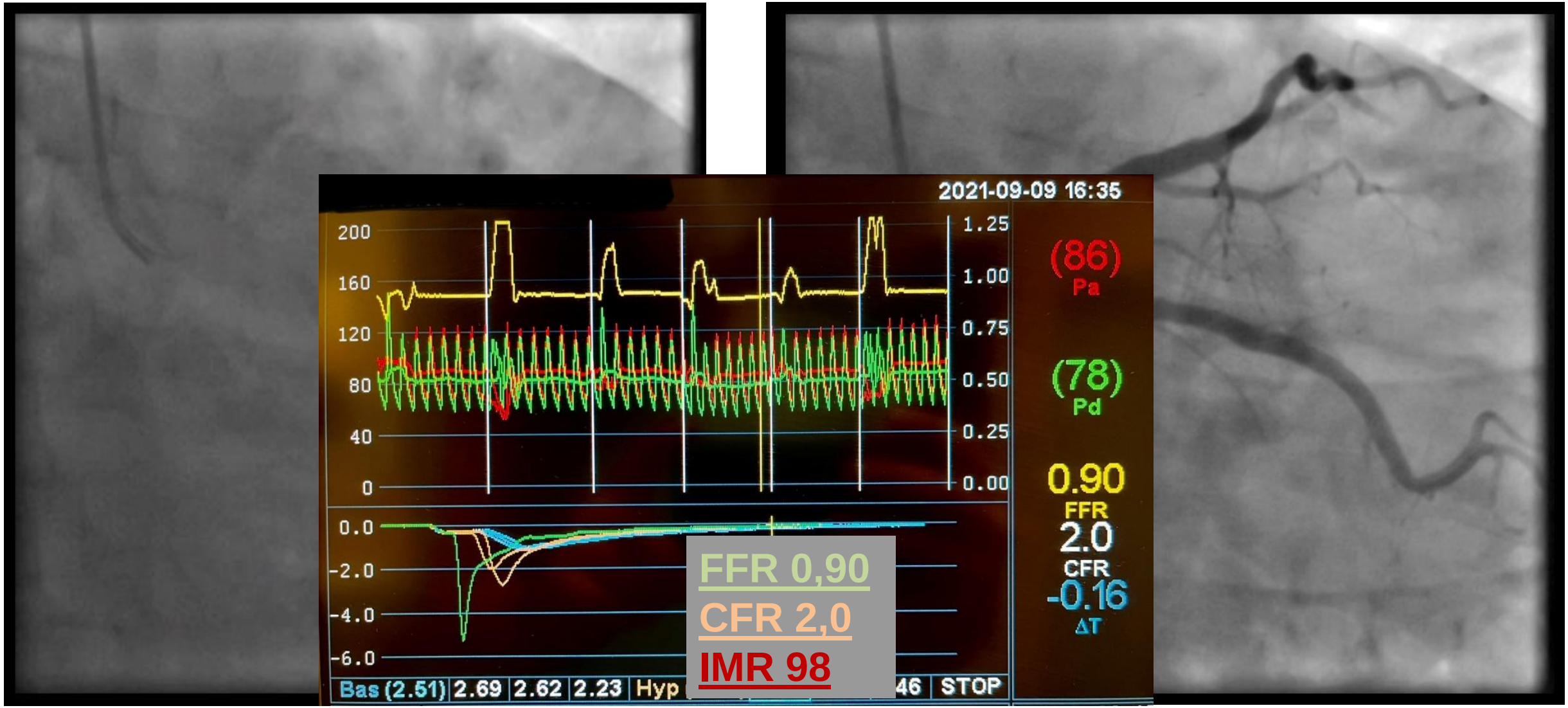
Ford et al. *JACC* 2018 Dec;72(23)

Dysfunkce endotelu po Ach
Ž, 48 let, dyZE + PS



Courtesy: J. Tremmel

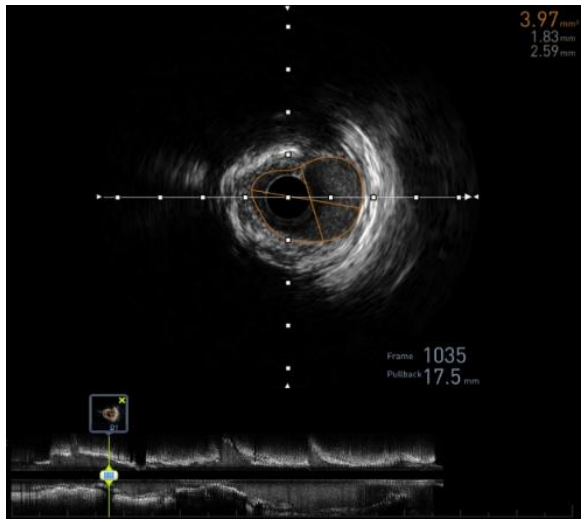
Muž, 70 let, steno nově - NSTE-AKS s nízkým rizikem
NIDDM na PAD, HT, HLP, BMI 30

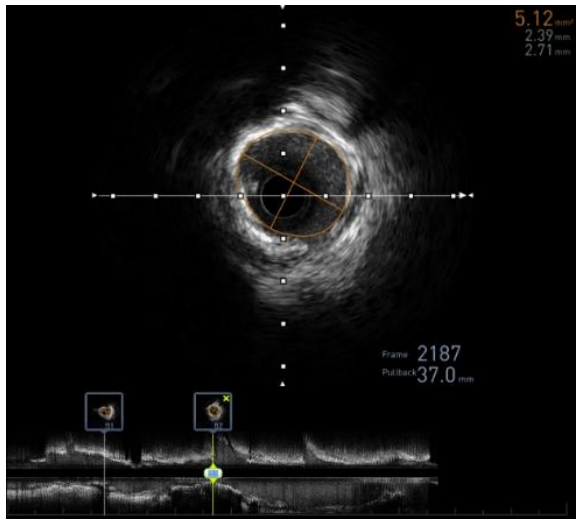


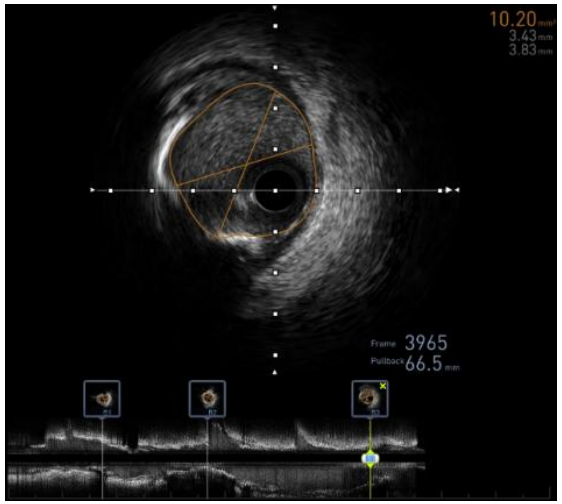
ACS s difuzním neobstruktivním nástěnným postižení, pomalé flow v RIA

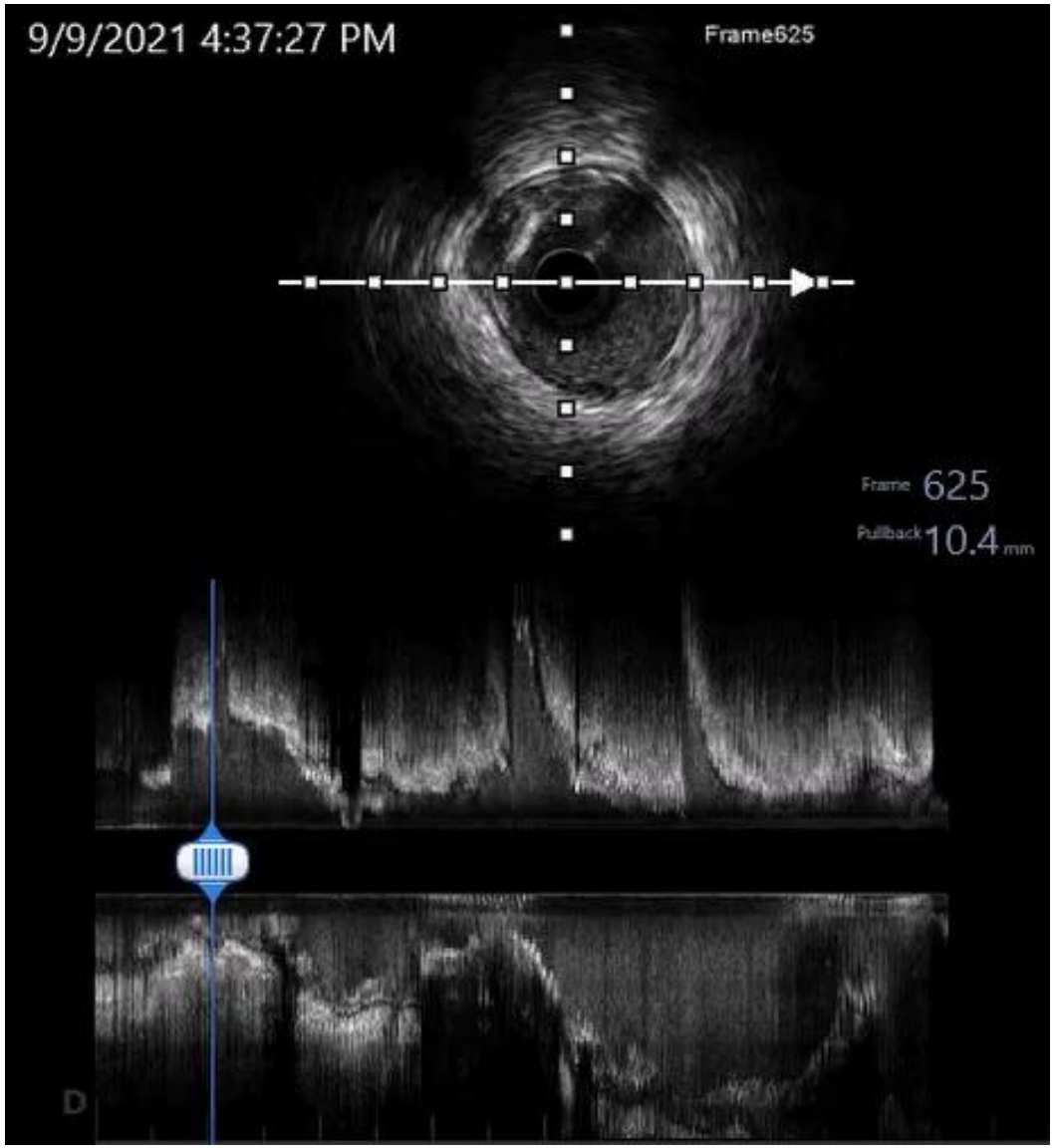
Archiv autora

IVUS kmen ACS-RIA



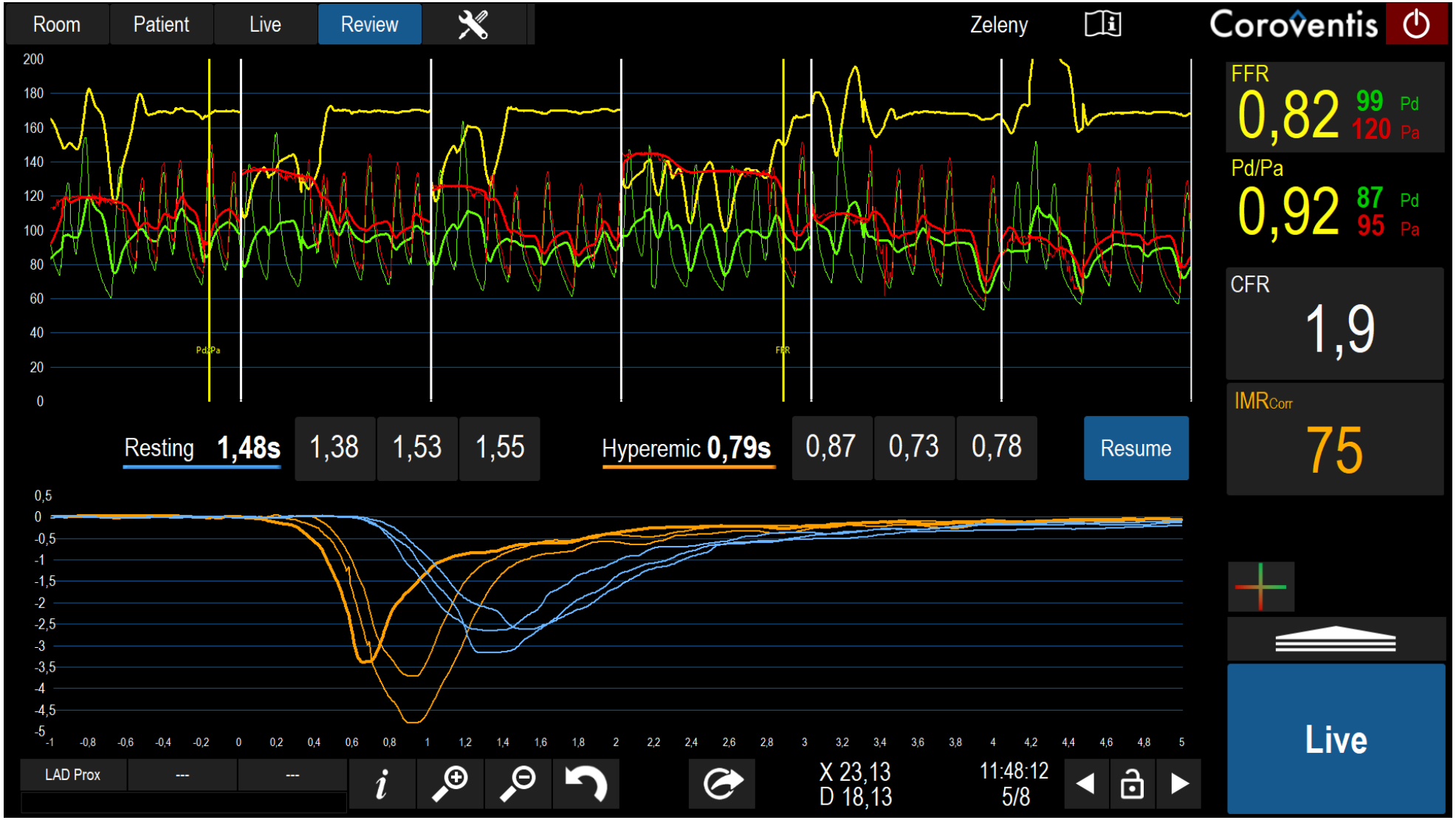






Archiv autora

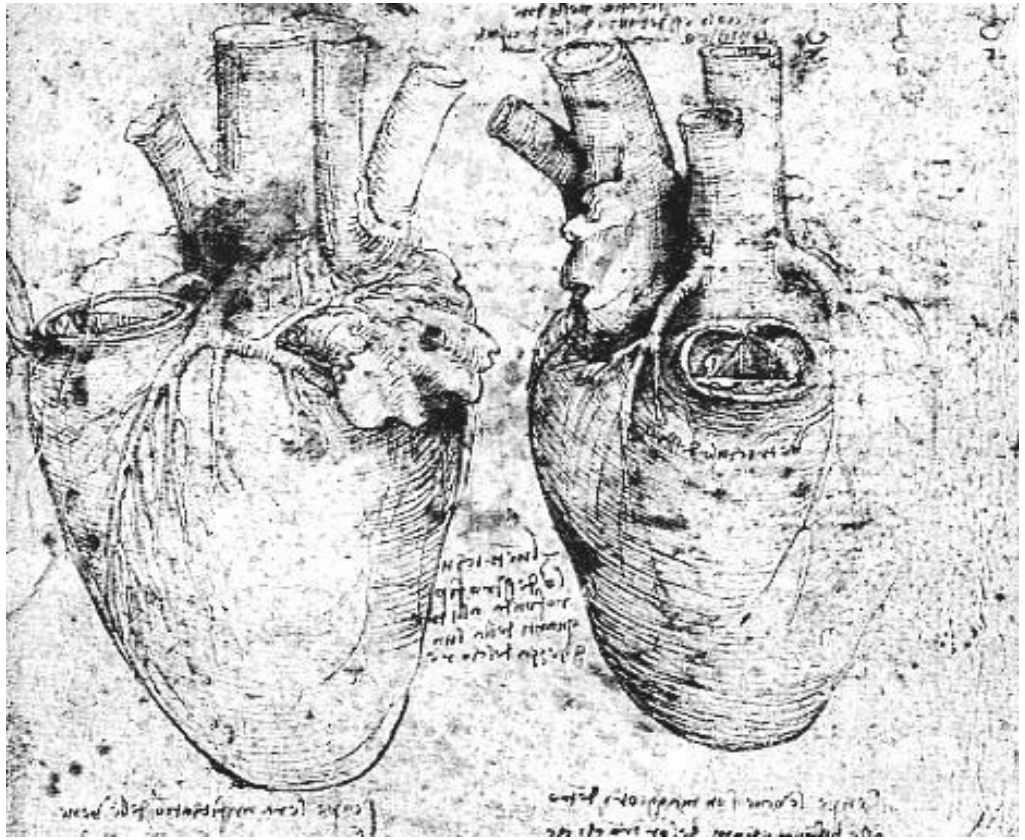
Coroventis software
CFR a IMR (+ FFR)



Coroventis software
CFR, FFR, MRR

Koronární nemoc trochu jinak aneb vše od Leonarda da Vinci je krásné, ale černobílá kresba barevný obraz nenahradí…

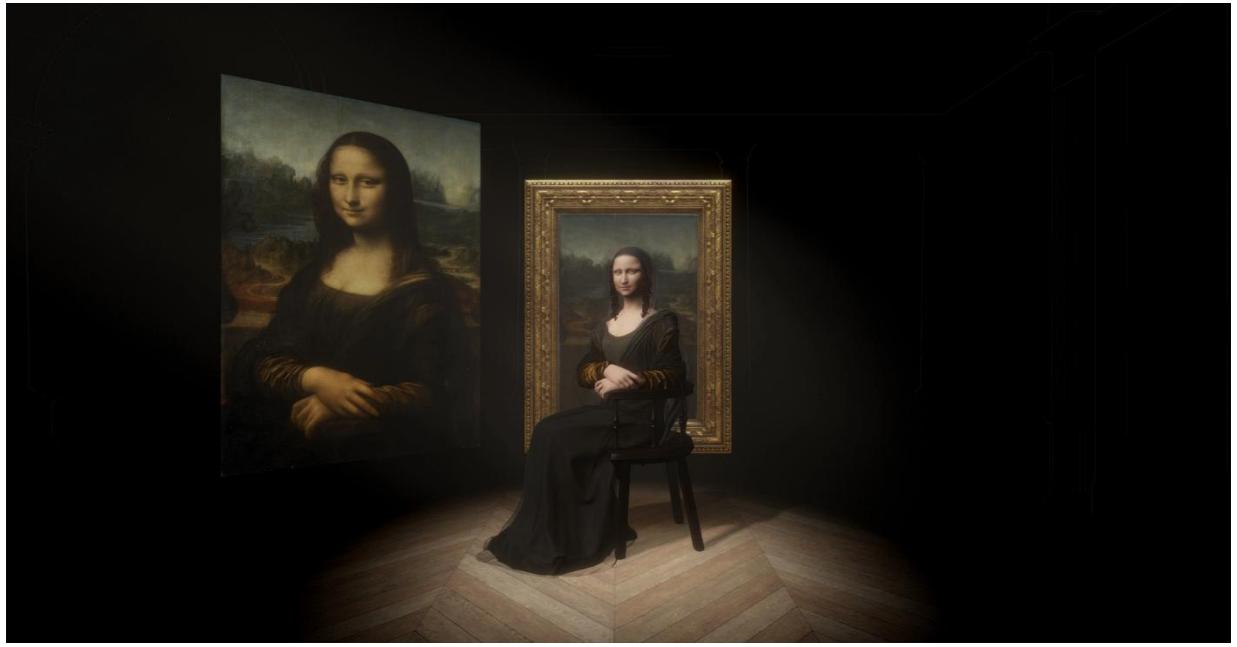
Koronarografie



Zdroj: https://leonardodavinci.stanford.edu/projects/anatomy/heart1.jpg

Koronarografie

+ koronární fyziologie a imaging



Zdroj: https://www.louvre.fr