

# Revaskularizace myokardu: Kdy PCI a kdy CABG?

Vojtěch Novotný





Every ~~BREATH~~ you take  
**STENT**

Like a ~~VIRGIN~~  
**SURVIVAL**



**ESC**

European Society  
of Cardiology

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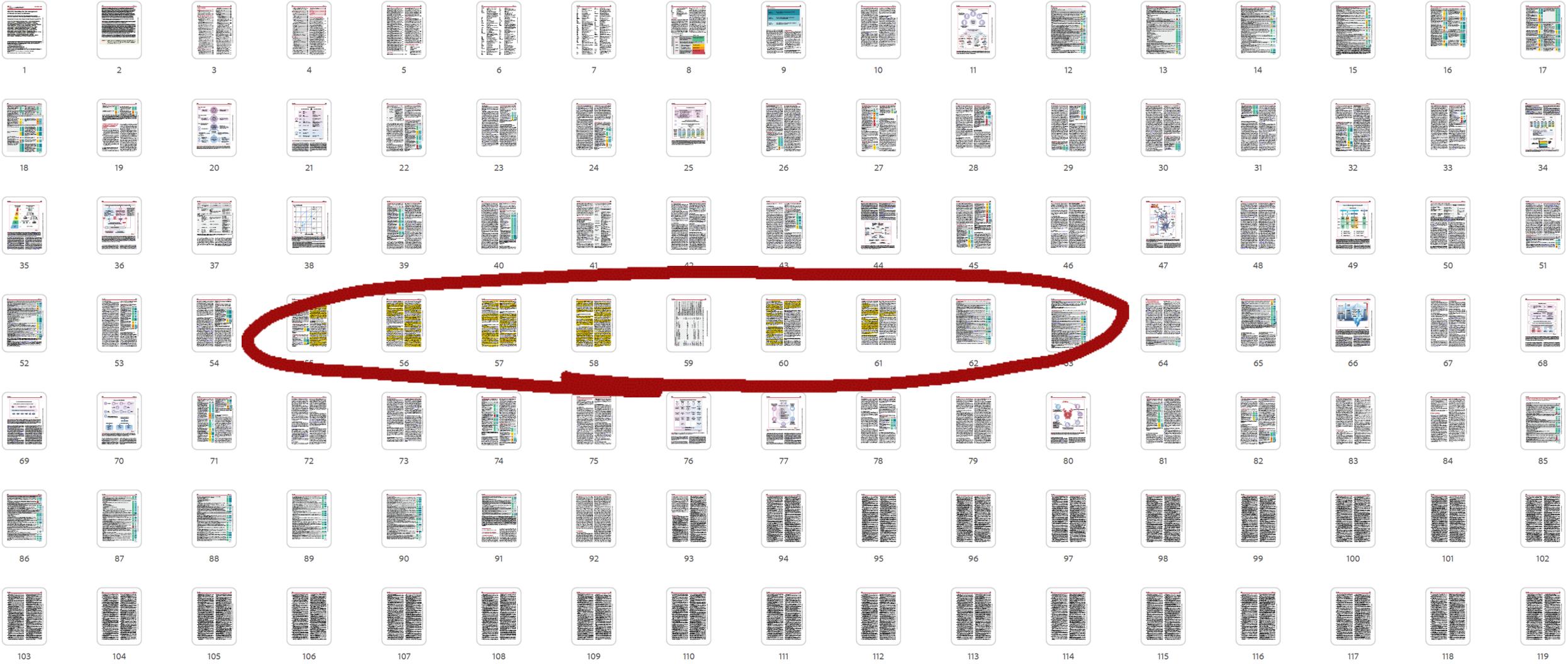
**ESC GUIDELINES**

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# **2024 ESC Guidelines for the management of chronic coronary syndromes**

**Developed by the task force for the management of chronic  
coronary syndromes of the European Society of Cardiology (ESC)**

***Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS)***



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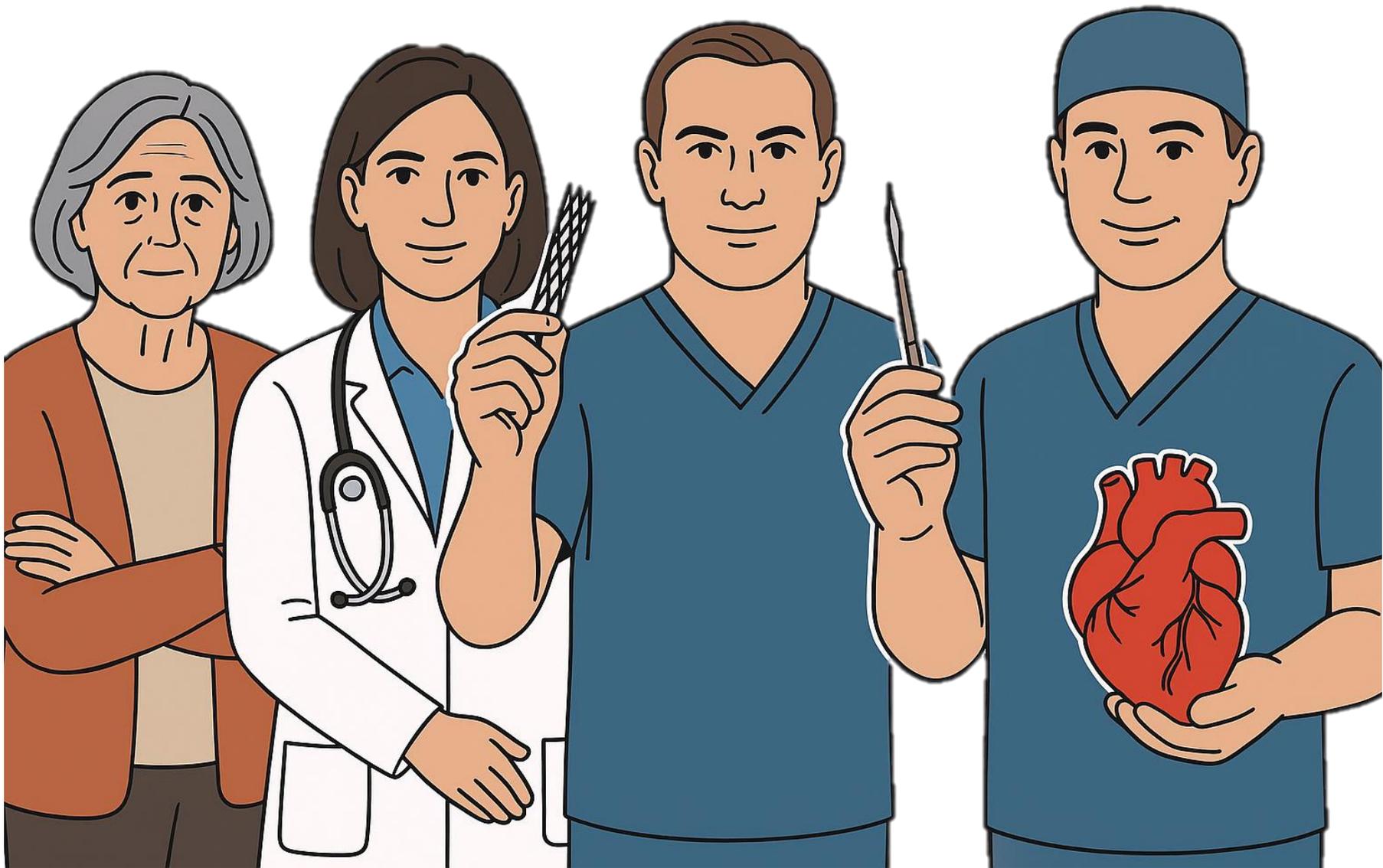
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# Cíle přednášky

- zjednodušený a praktický pohled na indikaci PCI a CABG podle guidelines ESC 2024
- upozornit na limity guidelines a realitu klinické praxe

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>	Choice of revascularization modality		
<b>Informed and shared decisions</b>			It is recommended that physicians select the most appropriate revascularization modality based on patient profile, <sup>c</sup> coronary anatomy, <sup>d</sup> procedural factors, <sup>e</sup> LVEF, preferences, and outcome expectations. <sup>719,725,728,792-795,801,816,820,822,859,869</sup>	I	C
It is recommended that patients scheduled for percutaneous or surgical revascularization receive complete information about the benefits, risks, therapeutic consequences, and alternatives to revascularization, as part of shared clinical decision-making. <sup>847,848,857</sup>	I	C			
For complex clinical cases, to define the optimal treatment strategy, in particular when CABG and PCI hold the same level of recommendation, a Heart Team discussion is recommended, including representatives from interventional cardiology, cardiac surgery, non-interventional cardiology, and other specialties if indicated, aimed at selecting the most appropriate treatment to improve patient outcomes and quality of life.	I	C			
It is recommended to communicate the proposal of the Heart Team in a balanced way using language that the patient can understand.	I	C			
It is recommended that the decision for revascularization and its modality be patient-centred, considering patient preferences, health literacy, cultural circumstances, and social support. <sup>849-851</sup>	I	C			
It is recommended that the Heart Team (on site or with a partner institution) develop institutional protocols to implement the appropriate revascularization strategy in accordance with current guidelines. <sup>855,856,858</sup>	I	C			
<b>Revascularization to improve outcomes</b>					
In chronic coronary syndrome patients with left ventricular ejection fraction >35%					
In CCS patients with LVEF >35%, myocardial revascularization is recommended, in addition to guideline-directed medical therapy, for patients with functionally significant left main stem stenosis to improve survival. <sup>718,719,859,860</sup>	I	A			
In CCS patients with LVEF >35%, myocardial revascularization is recommended, in addition to guideline-directed medical therapy, for patients with functionally significant three-vessel disease to improve long-term survival and to reduce long-term cardiovascular mortality and the risk of spontaneous myocardial infarction. <sup>55,56,317,732-734</sup>	I	A			
In CCS patients with LVEF >35%, myocardial revascularization is recommended, in addition to guideline-directed medical therapy, for patients with functionally significant single- or two-vessel disease involving the proximal LAD, to reduce long-term cardiovascular mortality and the risk of spontaneous myocardial infarction. <sup>55,56,317,719,732-734</sup>	I	B			
In chronic coronary syndrome patients with left ventricular ejection fraction ≤35%					
In CCS patients with LVEF ≤35%, it is recommended to choose between revascularization or medical therapy alone, after careful evaluation, preferably by the Heart Team, of coronary anatomy, correlation between coronary artery disease and LV dysfunction, comorbidities, life expectancy, individual risk-to-benefit ratio, and patient perspectives.	I	C			
In surgically eligible CCS patients with multivessel CAD and LVEF ≤35%, myocardial revascularization with CABG is recommended over medical therapy alone to improve long-term survival. <sup>53,54,749,861</sup>	I	B			
In selected CCS patients with functionally significant MVD and LVEF ≤35% who are at high surgical risk or not operable, PCI may be considered as an alternative to CABG. <sup>526,729</sup>	IIb	B			
<b>Revascularization to improve symptoms</b>					
In CCS patients with persistent angina or anginal equivalent, despite guideline-directed medical treatment, myocardial revascularization of functionally significant obstructive CAD is recommended to improve symptoms. <sup>50,321,402,732,734,757</sup>	I	A			
<b>Assessment of procedural risks and post-procedural outcomes</b>					
In patients with complex CAD in whom revascularization is being considered, it is recommended to assess procedural risks and post-procedural outcomes to guide shared clinical decision-making.	I	C			
Calculation of the STS score is recommended to estimate in-hospital morbidity and 30-day mortality after CABG. <sup>777,862-864</sup>	I	B			
In patients with multivessel obstructive CAD, calculation of the SYNTAX score is recommended to assess the anatomical complexity of disease. <sup>786,865</sup>	I	B			
Intracoronary imaging guidance by IVUS or OCT is recommended when performing PCI on anatomically complex lesions, in particular left main stem, true bifurcations, and long lesions. <sup>866,337,810,840,841</sup>	I	A			
Intracoronary pressure measurement (FFR or iFR) or computation (QFR) :					
• is recommended to guide lesion selection for intervention in patients with multivessel disease; <sup>308,826,866,867</sup>	I	A			
• should be considered at the end of the procedure to identify patients at high risk of persistent angina and subsequent clinical events; <sup>828,830,831,868</sup>	IIa	B			
• may be considered at the end of the procedure to identify lesions potentially amenable to treatment with additional PCI. <sup>350,829,831</sup>	IIb	B			
			<b>Choice of revascularization modality</b>		
			It is recommended that physicians select the most appropriate revascularization modality based on patient profile, <sup>c</sup> coronary anatomy, <sup>d</sup> procedural factors, <sup>e</sup> LVEF, preferences, and outcome expectations. <sup>719,725,728,792-795,801,816,820,822,859,869</sup>	I	C
			CABG, coronary artery bypass grafting; CAD, coronary artery disease; CCS, chronic coronary syndrome; FFR, fractional flow reserve; iFR, instantaneous wave-free ratio; IVUS, intravascular ultrasound; LAD, left anterior descending; LV, left ventricular; LVEF, left ventricular ejection fraction; MVD, multivessel disease; OCT, optical coherence tomography; PCI, percutaneous coronary intervention; QFR, quantitative flow ratio; STS, Society of Thoracic Surgeons; SYNTAX, SYNTAX: Between PCI with TAXUS and Cardiac Surgery.		
			<sup>a</sup> Class of recommendation.		
			<sup>b</sup> Level of evidence.		
			<sup>c</sup> Age, frailty, cognitive status, diabetes, and any other comorbidities.		
			<sup>d</sup> Multivessel disease with/out left main stem involvement, high anatomical complexity, and likelihood of revascularization completeness.		
			<sup>e</sup> Local expertise and outcomes, surgical and interventional risk.		
			<b>Recommendation Table 23 — Recommendations for mode of revascularization in patients with chronic coronary syndrome (see also Evidence Table 23)</b>		
			<b>Anatomically and clinically based recommendations for revascularization in CCS</b>	Class <sup>a</sup>	Level <sup>b</sup>
			<b>Left main disease</b>		
			In CCS patients at low surgical risk <sup>c</sup> with significant left main coronary stenosis, CABG:		
			• is recommended over medical therapy alone to improve survival; <sup>719</sup>	I	A
			• is recommended as the overall preferred revascularization mode over PCI, given the lower risk of spontaneous myocardial infarction and repeat revascularization. <sup>728,730,782</sup>	I	A
			In CCS patients with significant left main coronary stenosis of low complexity (SYNTAX score ≤22), in whom PCI can provide equivalent completeness of revascularization to that of CABG, PCI is recommended as an alternative to CABG, given its lower invasiveness and non-inferior survival. <sup>718,728,730,802,813</sup>	I	A
			In CCS patients with significant left main coronary stenosis of intermediate complexity (SYNTAX score 23–32), in whom PCI can provide equivalent completeness of revascularization to that of CABG, PCI should be considered, given its lower invasiveness and non-inferior survival. <sup>718,728,730,802,805,809,813,820,822</sup>	IIa	A
			<b>Left main with multivessel disease<sup>d</sup></b>		
			In CCS patients at low surgical risk with suitable anatomy, CABG is recommended over medical therapy alone to improve survival. <sup>718,719,870</sup>	I	A
			In CCS patients at high surgical risk, PCI may be considered over medical therapy alone. <sup>728,813</sup>	IIb	B
			<b>Multivessel disease<sup>d</sup> and diabetes</b>		
			In CCS patients with significant multivessel disease and diabetes, with insufficient response to guideline-directed medical therapy, CABG is recommended over medical therapy alone and over PCI to improve symptoms and outcomes. <sup>801,824,871-874</sup>	I	A
			In CCS patients at very high surgical risk, PCI should be considered over medical therapy alone to reduce symptoms and adverse outcomes. <sup>55,874</sup>	IIa	B
			<b>Three-vessel disease, without diabetes</b>		
			In CCS patients with significant three-vessel disease, preserved LVEF, no diabetes, and insufficient response to guideline-directed medical therapy, CABG is recommended over medical therapy alone to improve symptoms, survival, and other outcomes. <sup>719,722,875</sup>	I	A
			In CCS patients with preserved LVEF, no diabetes, insufficient response to guideline-directed medical therapy, and significant three-vessel disease of low-to-intermediate anatomic complexity in whom PCI can provide similar completeness of revascularization to that of CABG, PCI is recommended, given its lower invasiveness, and generally non-inferior survival. <sup>326,728,795,798,876</sup>	I	A
			<b>Single- or double-vessel disease involving the proximal LAD</b>		
			In CCS patients with significant single- or double-vessel disease involving the proximal LAD and insufficient response to guideline-directed medical therapy, CABG or PCI is recommended over medical therapy alone to improve symptoms and outcomes. <sup>52,321,719,791,792</sup>	I	A
			In CCS patients with complex significant single- or double-vessel disease involving the proximal LAD, less amenable to PCI, and insufficient response to guideline-directed medical therapy, CABG is recommended to improve symptoms and reduce revascularization rates. <sup>877-879</sup>	I	B
			<b>Single- or double-vessel disease not involving the proximal LAD</b>		
			In symptomatic CCS patients with significant single- or double-vessel disease not involving the proximal LAD and with insufficient response to guideline-directed medical therapy, PCI is recommended to improve symptoms. <sup>50,321,732</sup>	I	B
			In symptomatic CCS patients with significant single- or double-vessel disease not involving the proximal LAD and with insufficient response to guideline-directed medical therapy, not amenable to revascularization by PCI, CABG may be considered to improve symptoms.	IIb	C





- vidí **všechny** typy nálezů
- řeší **skoro všechny** typy nálezů
- vidí **většinu** selhání PCI
- vidí **většinu** selhání CABG
- vidí **relativně méně** fungujících PCI/CABG



dušnost, angina nebo má „jen náleží“  
v neznámém světě kardiologie

protichůdné návrhy:  
„operace“ vs. „stent“ vs. „prášky“

sleduje pacienta, zná celkový  
stav, komorbidity

výsledky neinvazivních testů  
„startuje“ rozhodovací proces



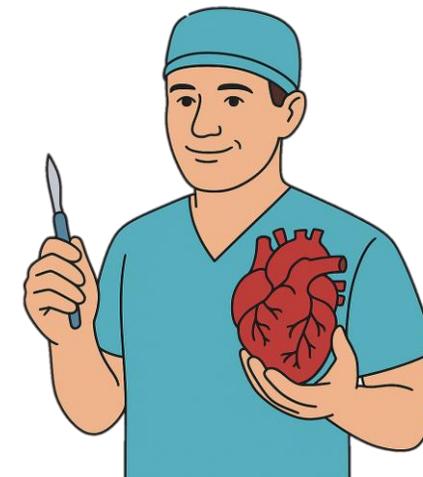
# Situace

hodnotí angiografii + ischemické nálezy  
rozhodování v reálném čase na katlabu

dilema:  
„mám to udělat sám, nebo poslat na  
chirurgii?“

dokumentace - CT, echo a angiografie  
diskuse o CABG často bez osobního  
kontaktu s pacientem

čelí operačnímu riziku a odpovědnosti





bezpečnost výkonu

návrat ke kvalitnímu životu (ne nutně „prodloužení“ života)

důvěra ve zdravotnický tým

jasná a lidská komunikace



prognostický přínos léčby

vyvážení benefitů vůči rizikům

koordinace mezi pacientem a specialisty

# Priority



technická proveditelnost PCI

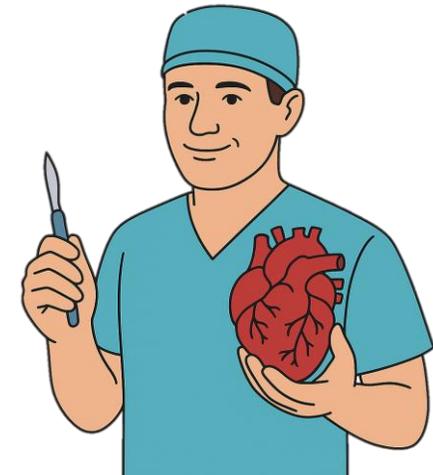
riziko komplikací během PCI

okamžitý benefit PCI vs. pozdější u CABG

technická možnost a bezpečnost CABG

dlouhodobý benefit CABG (DM, 3VD, kmen)

identifikace rizikových pacientů bez reálného benefitu





minimalizace bolesti, komplikací a ztráty autonomie

mít řešení, které „dává smysl“

touha „rychle zpátky do normálu“ – preferuje PCI, není-li přesvědčen o nutnosti CABG

odpovědnost za dlouhodobý výsledek

etický závazek být „advokátem pacienta“

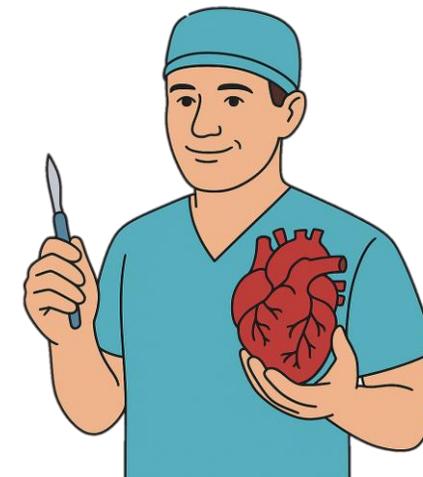
snížení symptomů, hospitalizací a MACE



# Motivace

chce a potřebuje intervenovat

chce a potřebuje operovat

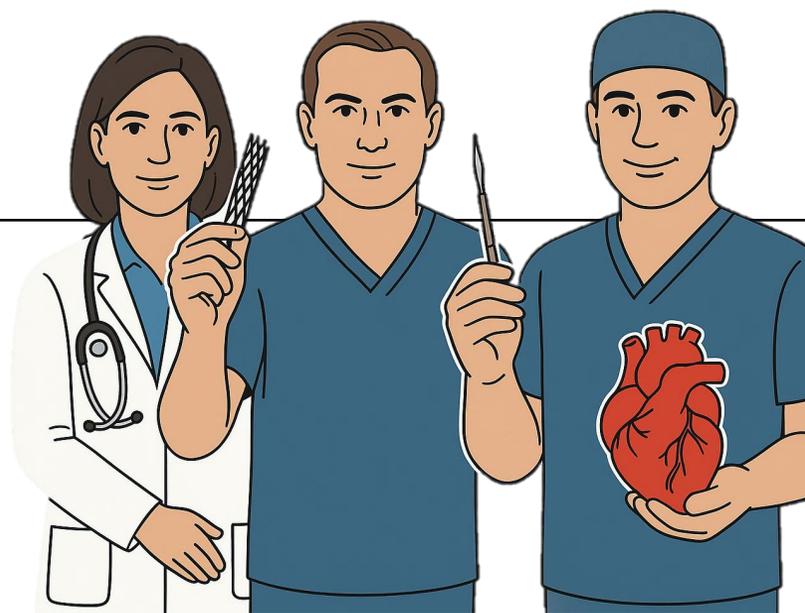


CHECK YOUR  
EGO  
AT THE DOOR



# Důvody pro revaskularizaci

Prognóza	Symptomy
kmen (EF >35%)	angina nebo ekvivalent
3 tepny (EF >35%)	
1-2 tepny včetně prox. RIA	
3 tepny (EF <35%)	



# PROMs - Patient Related Outcomes Measures

- anginózní symptomatologie (např. frekvence, závažnost)
- dušnost, únava, celková funkční zdatnost
- psychosociální dopad nemoci
- kvalita života související se zdravím ( SAQ, EQ-5D, SF-36)



Klinická situace	Doporučení	Úroveň	
Kmen (SYNTAX nízký)	PCI nebo CABG	I A	IIa B
Kmen (SYNTAX vysoký)	CABG	I A	
3 tepny + DM	CABG	I A	
3 tepny bez DM (nízká komplexita)	PCI nebo CABG	I A	
1-2 tepny bez prox. RIA	PCI	I B	
1-2 tepny s prox. RIA	PCI nebo CABG	I A	
EF $\leq$ 35% + nemoc více tepen	CABG	I B	
EF $\leq$ 35% + vysoké chirurgické riziko	PCI zvážit	IIb B	

Klinická situace	Doporučení	Úroveň	
Kmen (SYNTAX nízký)	PCI nebo CABG	I A	IIa B
Kmen (SYNTAX vysoký)	CABG	I A	
3 tepny + DM	CABG	I A	
3 tepny bez DM (nízká komplexita)	PCI nebo CABG	I A	
1-2 tepny bez prox. RIA	PCI	I B	
1-2 tepny s prox. RIA	PCI nebo CABG	I A	
EF ≤ 35% + nemoc více tepen	CABG	I B	
EF ≤ 35% + vysoké chirurgické riziko	PCI zvážit	IIb B	

Klinická situace	Doporučení	Úroveň	
Kmen (SYNTAX nízký)	PCI nebo CABG	I A	IIa B
Kmen (SYNTAX vysoký)	CABG	I A	
3 tepny + DM	CABG	I A	
3 tepny bez DM (nízká komplexita)	PCI nebo CABG	I A	
1-2 tepny bez prox. RIA	PCI	I B	
1-2 tepny s prox. RIA	PCI nebo CABG	I A	
EF ≤ 35% + nemoc více tepen	CABG	I B	
EF ≤ 35% + vysoké chirurgické riziko	PCI zvážit	IIb B	

# 2024 ESC Guidelines for the management of chronic coronary syndromes



- preference CABG u komplexních pacientů s vysokým ischemickým rizikem
- PCI při nižší anatomické komplexitě nebo vysokém chirurgickém riziku

# Klinické studie

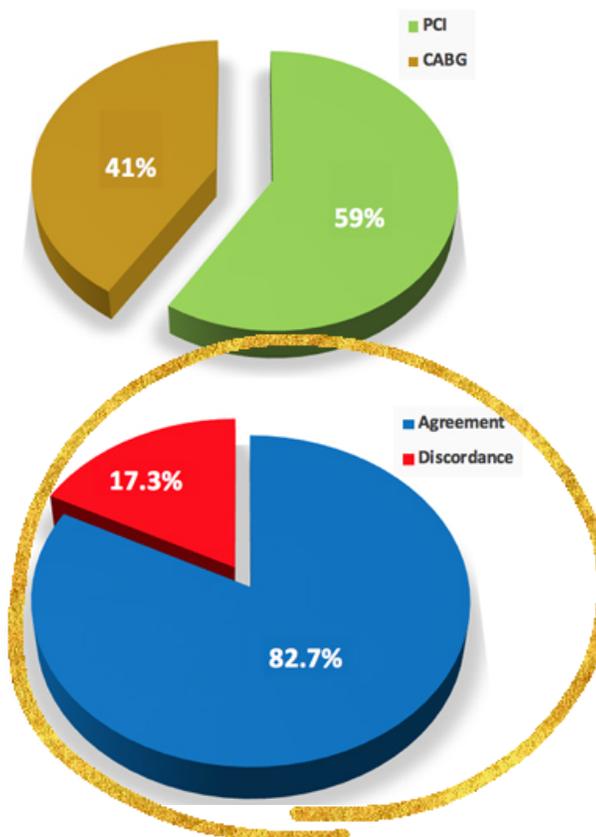
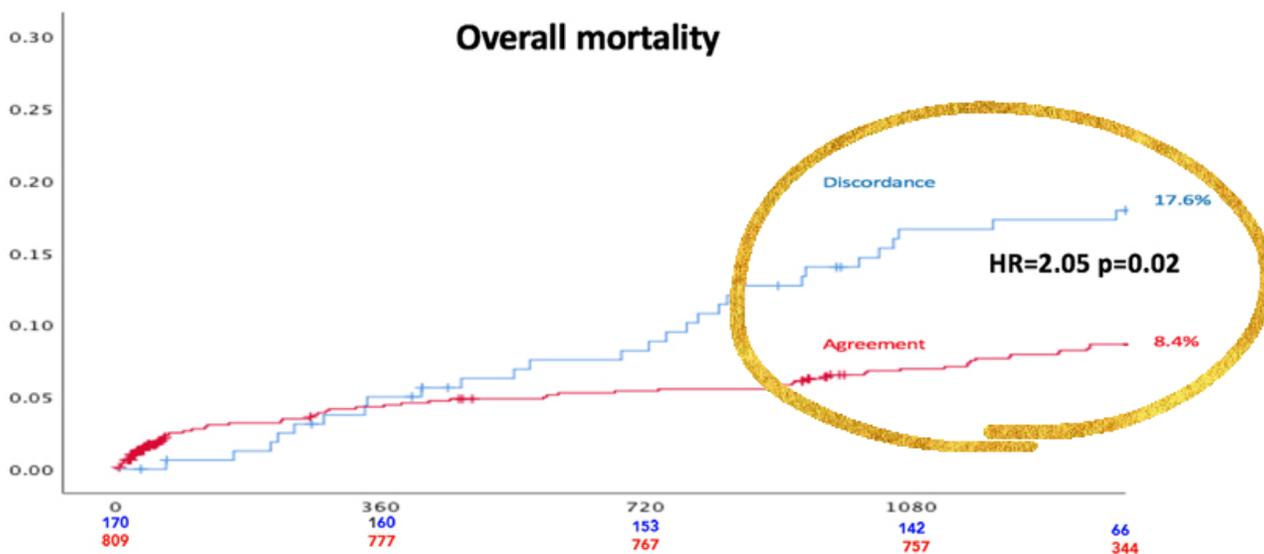
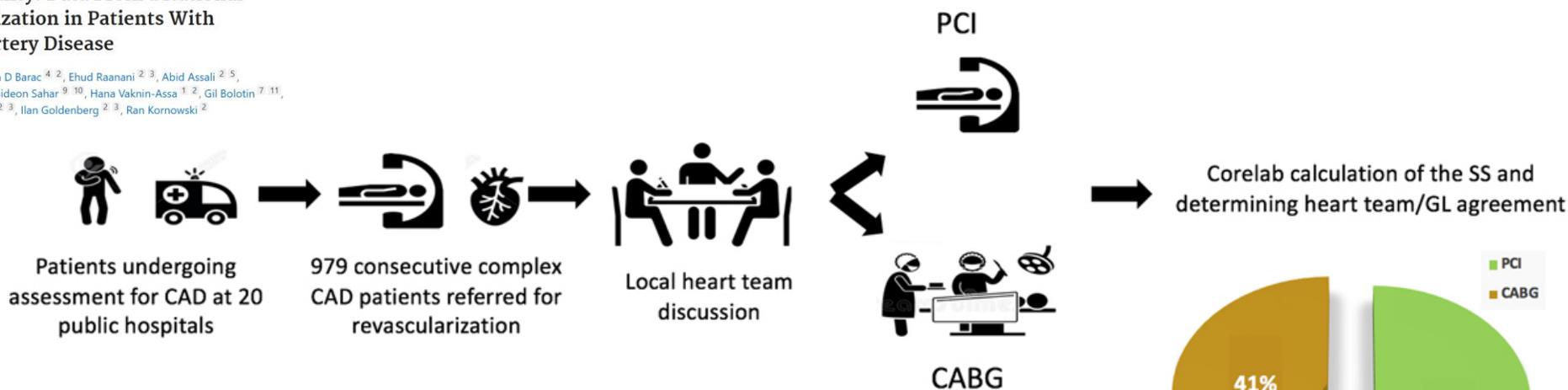
<b>Klinická situace</b>	<b>Klíčové studie</b>
Kmen	SYNTAX(ES), EXCEL, NOBLE, PRECOMBAT
MVD + DM	FREEDOM
MVD bez DM	SYNTAX(ES), FAME 3
EF ≤35 %	STICH, REVIVED-BCIS2
proximální RIA	Patel 2022, Gianoli 2022 (meta-analýzy)
1-2 tepny bez prox. RIA	subanalýzy včetně SYNTAX, menší RCT

# Studie PCI vs. CABG u MVD+/-LM

- vstupní kritéria umožňující PCI i CABG s relativně nízkým rizikem
- 6-40% eligible pacientů bylo zařazeno
- mladší populace s nižším výskytem komorbidit
- průměrný věk <66 let

# Heart Team/Guidelines Discordance Is Associated With Increased Mortality: Data From a National Survey of Revascularization in Patients With Complex Coronary Artery Disease

Guy Witberg<sup>1,2</sup>, Amit Segev<sup>2,3</sup>, Yaron D Barac<sup>4,2</sup>, Ehud Raanani<sup>2,3</sup>, Abid Assali<sup>2,5</sup>, Ariel Finkelstein<sup>2,6</sup>, Ariel Roguin<sup>7,8</sup>, Gideon Sahar<sup>9,10</sup>, Hana Vaknin-Assa<sup>1,2</sup>, Gil Bolotin<sup>7,11</sup>, Amnon Eitan<sup>7,12</sup>, Robert Klempfner<sup>1,2,3</sup>, Ilan Goldenberg<sup>2,3</sup>, Ran Kornowski<sup>2</sup>



věk, předchozí IM/PCI, špatná mobilita, nechirurgické centrum, CTO, vysoké SYNTAX skóre



- tzv. „surgical turndown“
- vysoce riziková populace
- málo dat
- studie OPTIMUM

726 pacientů  
(MVD či kmen)

celková mortalita  
5,6% po 30 dnech  
12,3% po 6 měsících

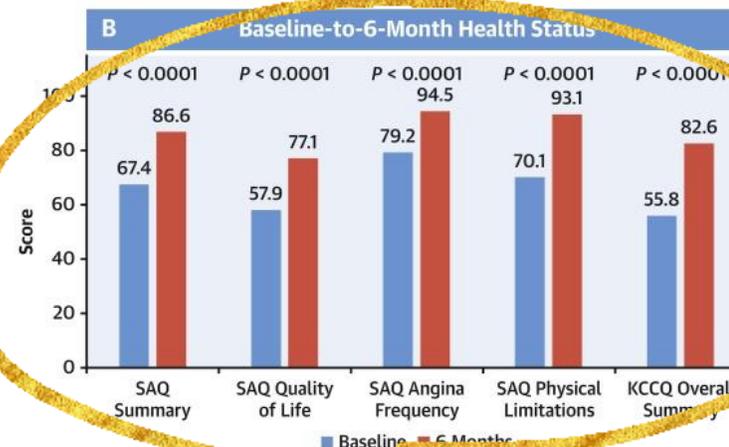
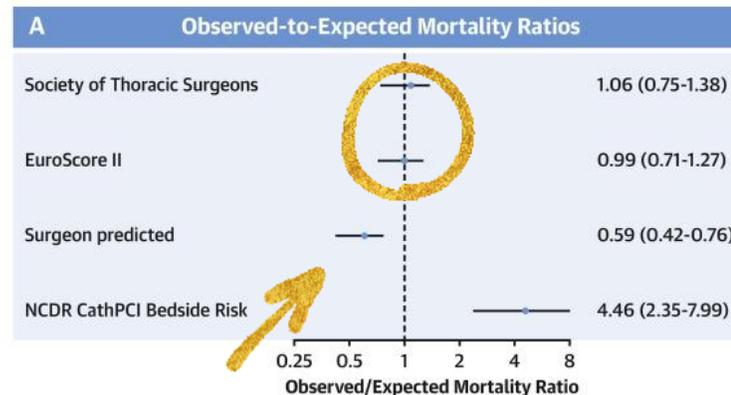
## Outcomes of Medical Therapy Plus PCI for Multivessel or Left Main CAD Ineligible for Surgery

Adam C. Salisbury MD, MSc<sup>a,b</sup>, J. Aaron Grantham MD<sup>a,b</sup>, W. Morris Brown MD<sup>c</sup>,  
William L. Ballard MD<sup>c</sup>, Keith B. Allen MD<sup>a,b</sup>, Ajay J. Kirtane MD, SM<sup>d</sup>, Michael Argenziano MD<sup>d</sup>,  
Robert W. Yeh MD, MSc<sup>e</sup>, Kamal Khabbaz MD<sup>e</sup>, John Lasala MD<sup>f</sup>, Puja Kachroo MD<sup>f</sup>,  
Dimitri Karpaliotis MD<sup>d</sup>, Jeffrey Moses MD<sup>d</sup>, William L. Lombardi MD<sup>g</sup>, Karen Nugent RRT<sup>a</sup>,  
Ziad Ali MD<sup>d</sup>, Kensey L. Gosch MS<sup>a</sup>, John A. Spertus MD, MPH<sup>a,b</sup>, David E. Kandzari MD<sup>c</sup>,  
OPTIMUM Investigators



### CENTRAL ILLUSTRATION: Study Overview and Main Results

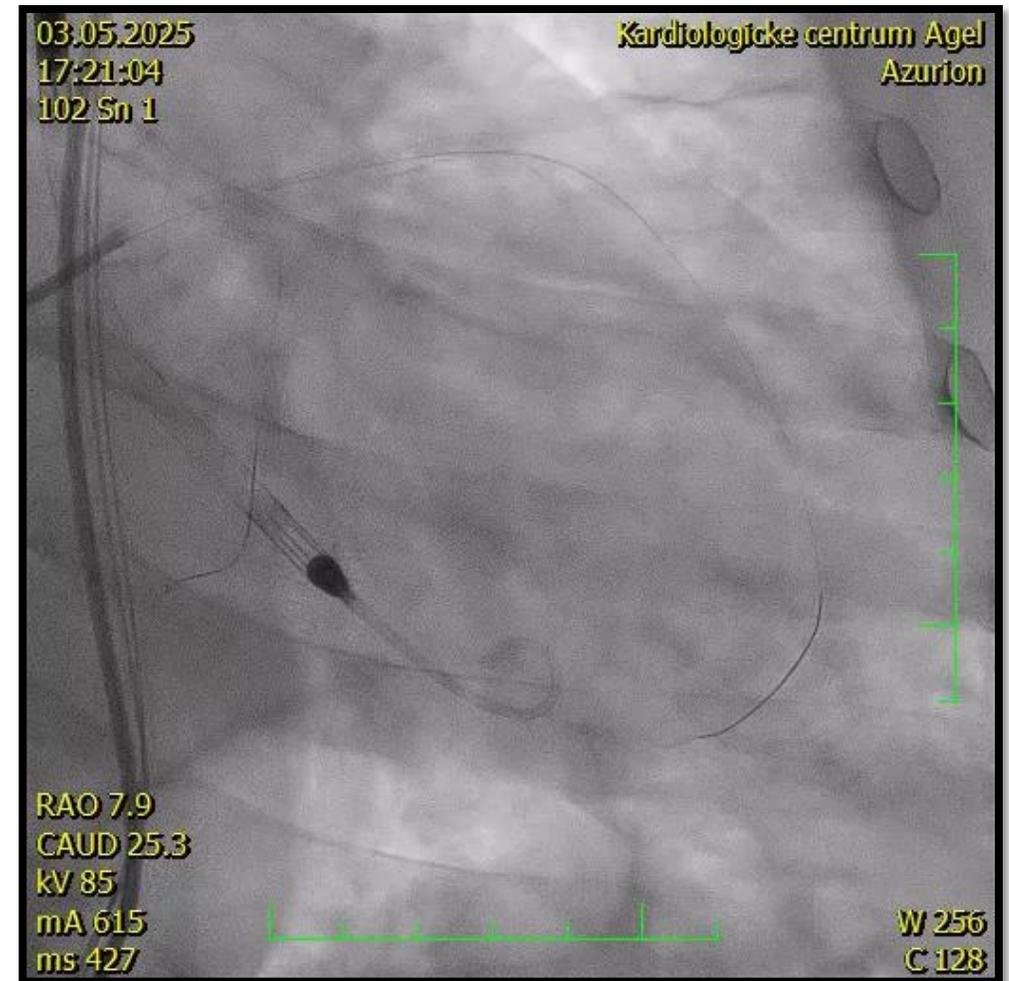
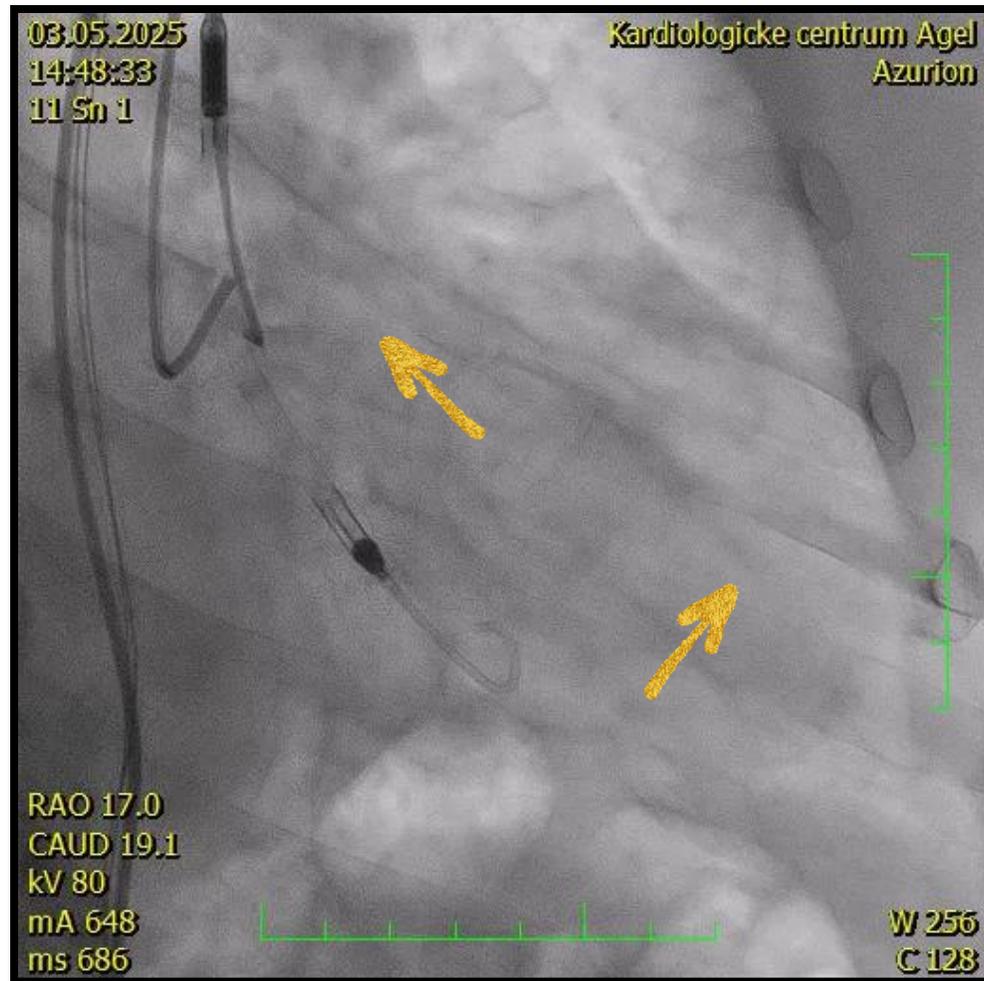
#### PCI Outcomes and Mortality Risk Scores for Surgically Ineligible Patients With Left Main or Multivessel CAD (N = 726)



# Nejčastější guidelines vs. reality gap

- 3 tepny +/- kmen, nízká EF
- **nevhodní pro operaci**  
křehkost, komorbidity (CKD), předchozí operace...
- PCI jako **plán B**

# HFrEF, EF 30%, CKD



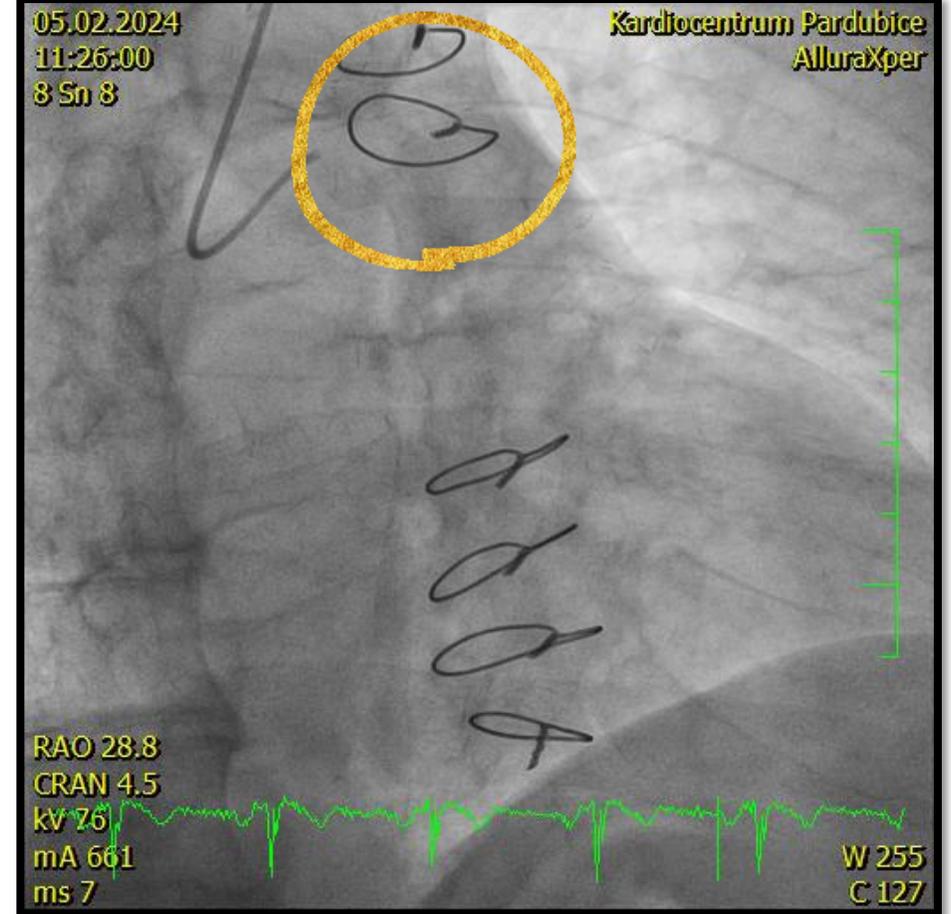
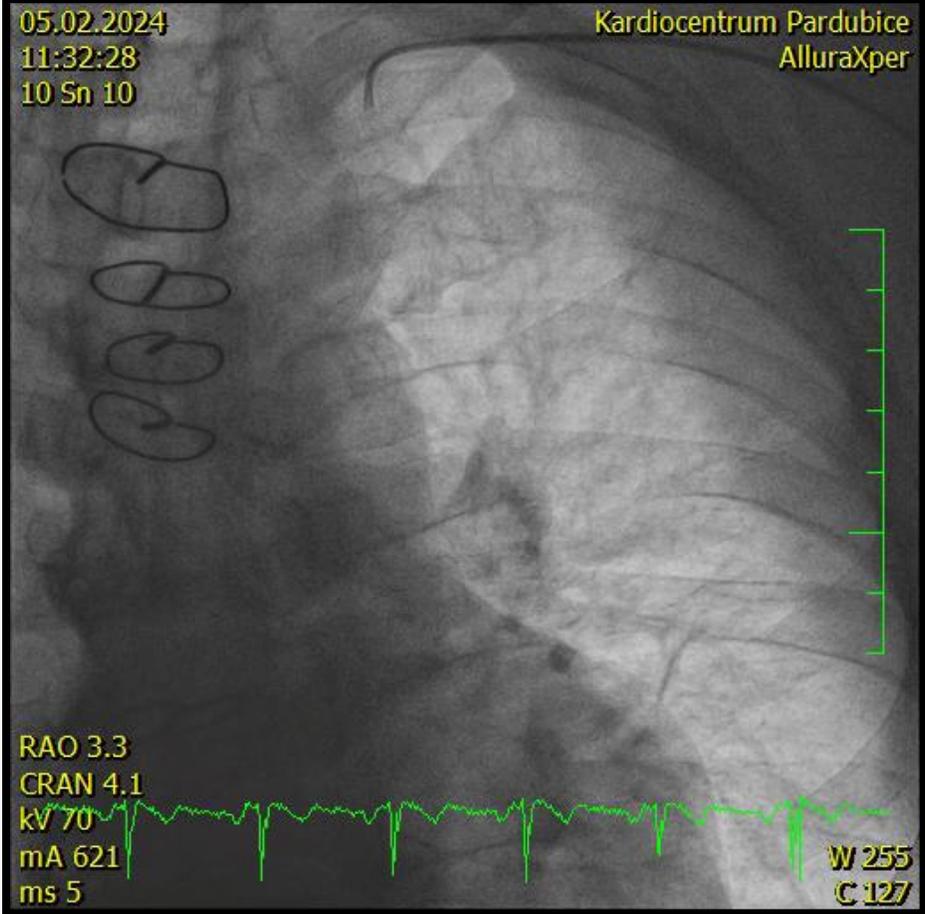
# Trvanlivost štěpů

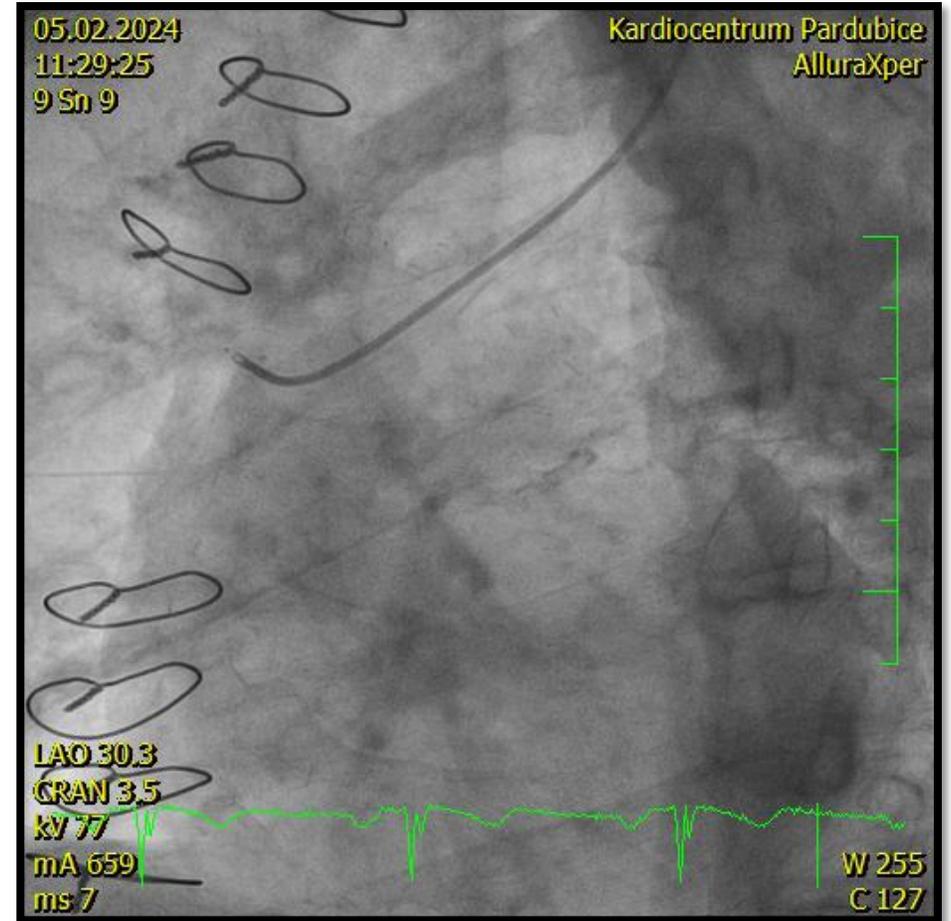
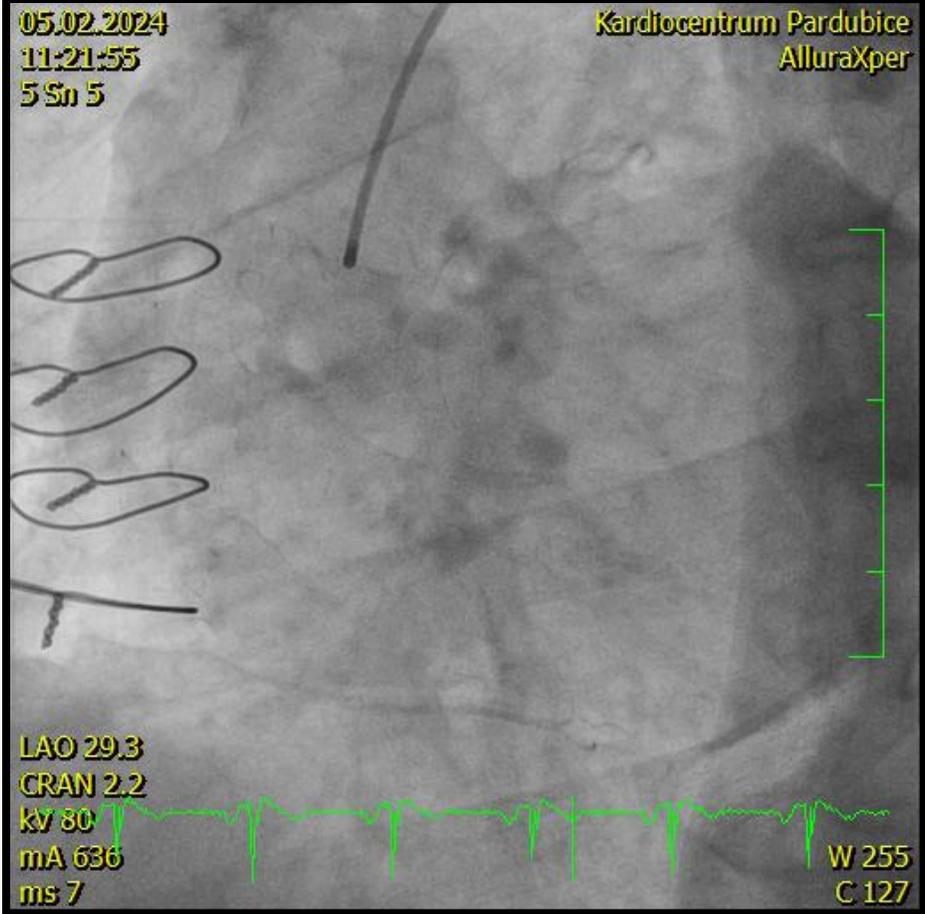
<b>Časové období</b>	<b>průchodnost LIMA- RIA</b>	<b>průchodnost SVG</b>
<b>1 rok</b>	90–95 %	75–85 %
<b>3 roky</b>	90 %	60–70 %
<b>5 let</b>	85–90 %	50–60 %
<b>10 let</b>	80–90 %	30–50 %

# Trvanlivost štěpů

Časové období	průchodnost LIMA- RIA	průchodnost SVG
1 rok	90–95 %	75–85 %
3 roky	90 %	60–70 %
5 let	85–90 %	50–60 %
10 let	80–90 %	30–50 %

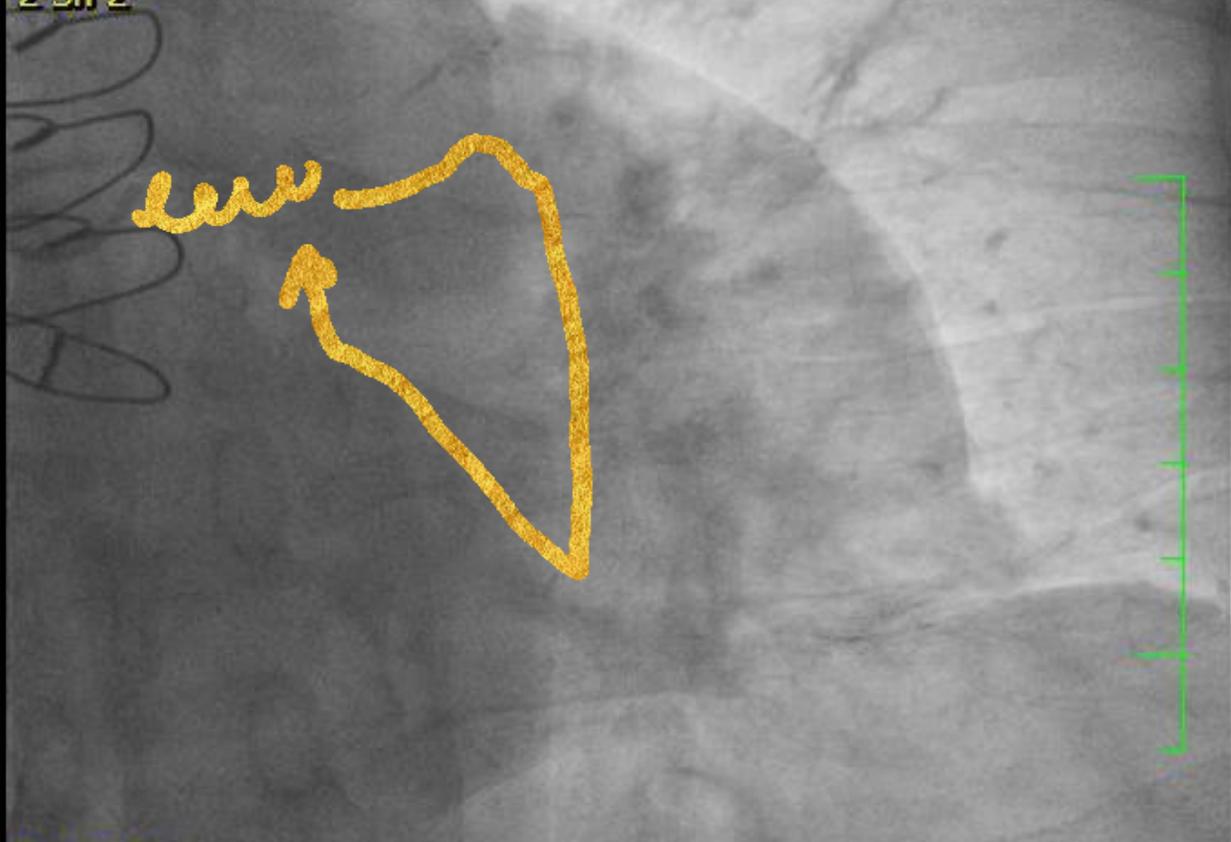
- plně arteriální revaskularizace: u cca 10–15 % CABG





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Kardiocentrum Pardubice  
AlluraXper

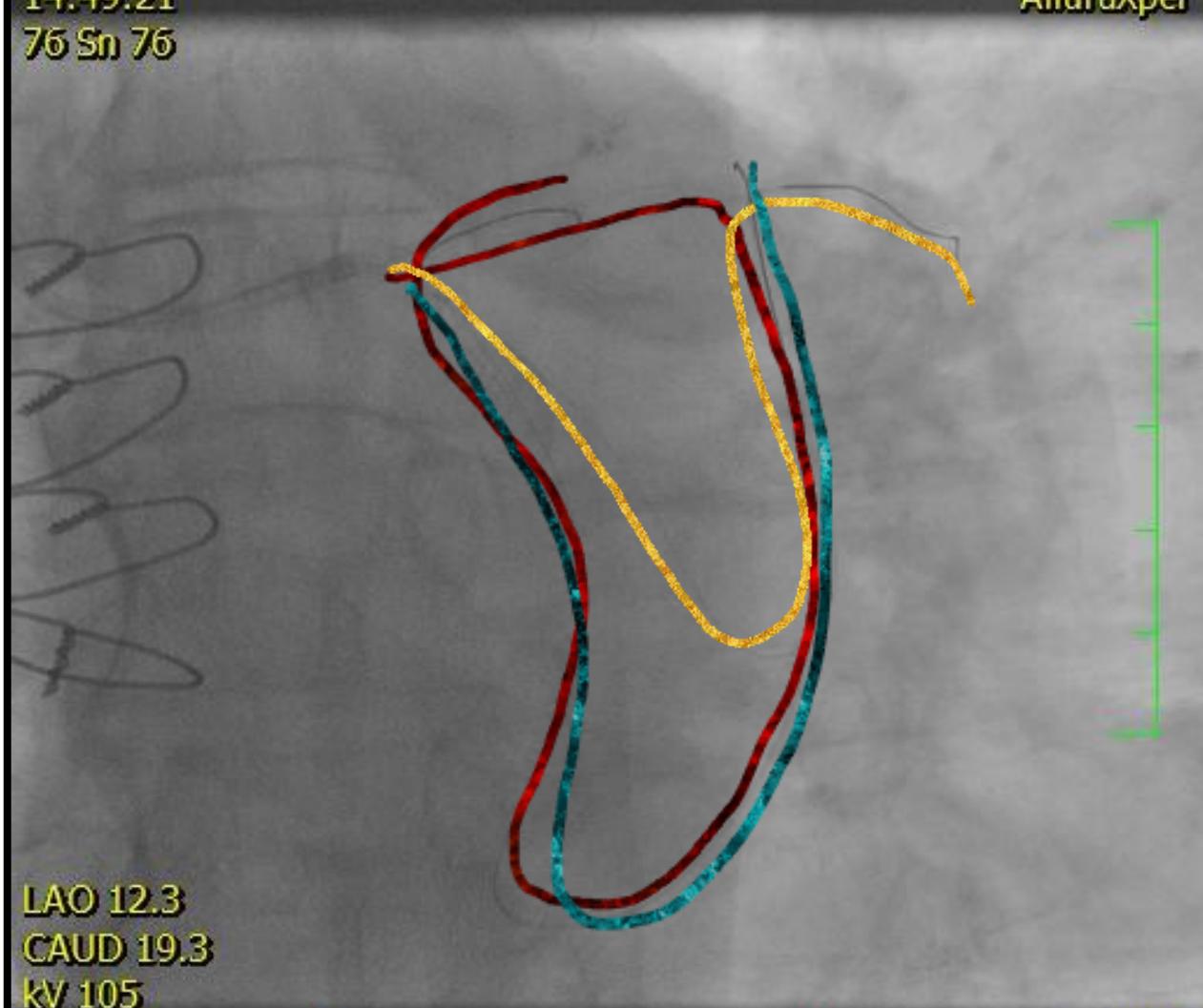


RAO 0.5  
CAUD 22.5  
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mA 643  
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C 127

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Kardiocentrum Pardubice  
AlluraXper



LAO 12.3  
CAUD 19.3  
kV 105  
mA 542  
ms 10

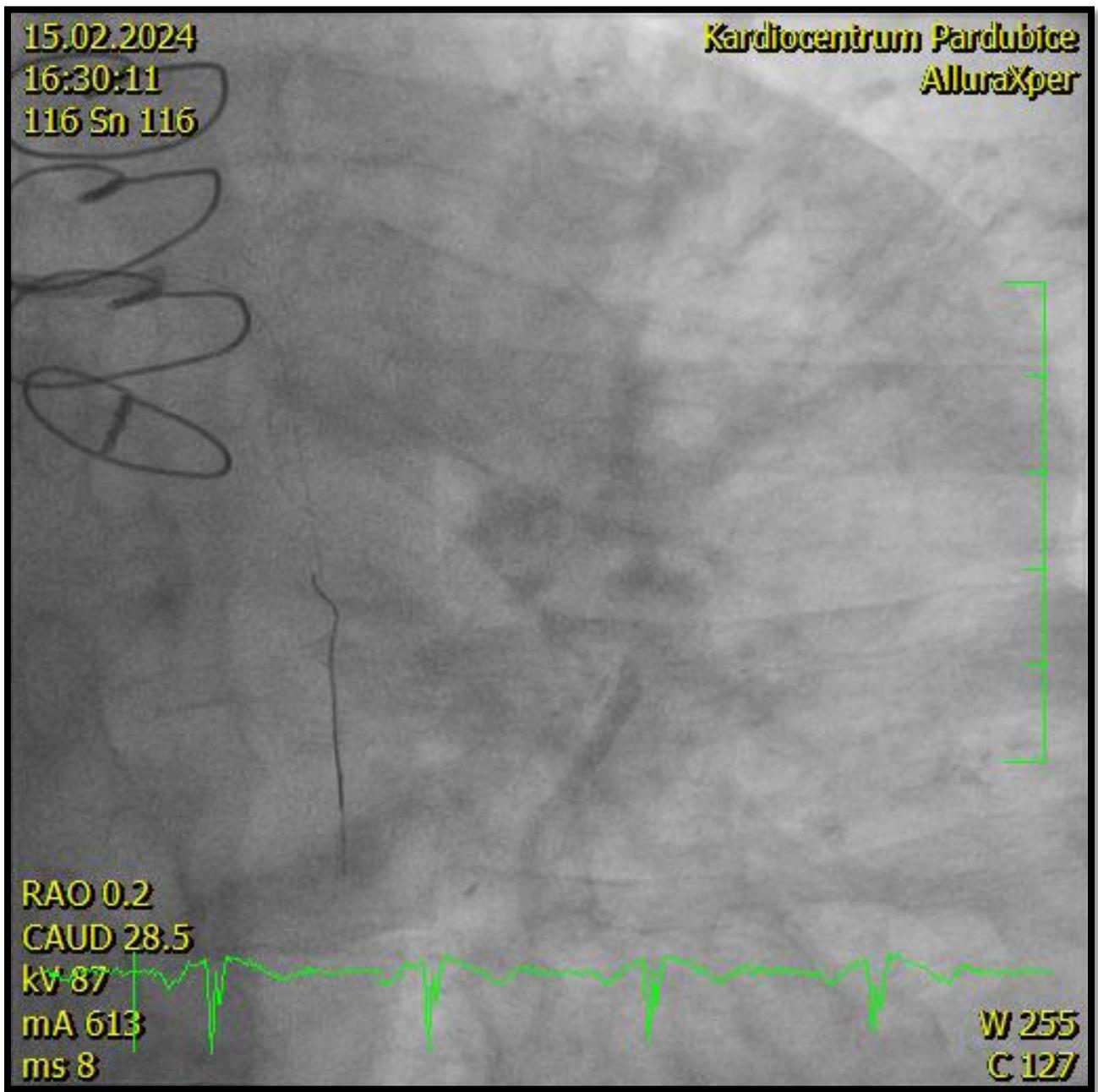
W 255  
C 127

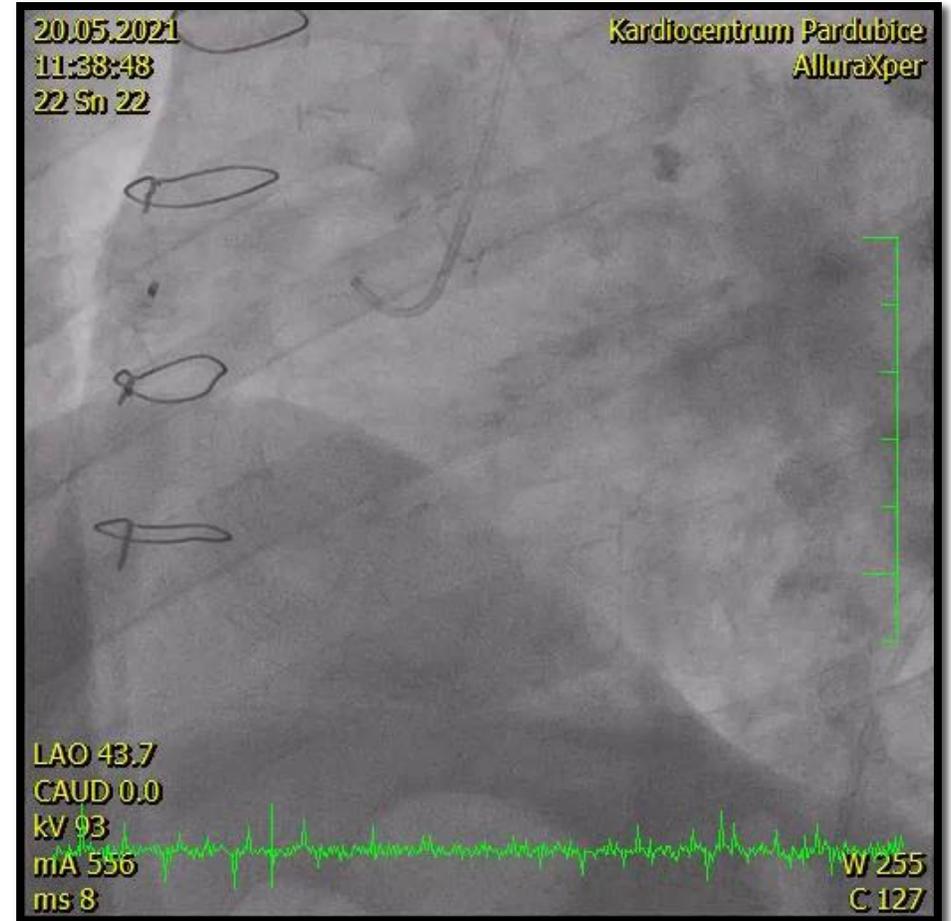
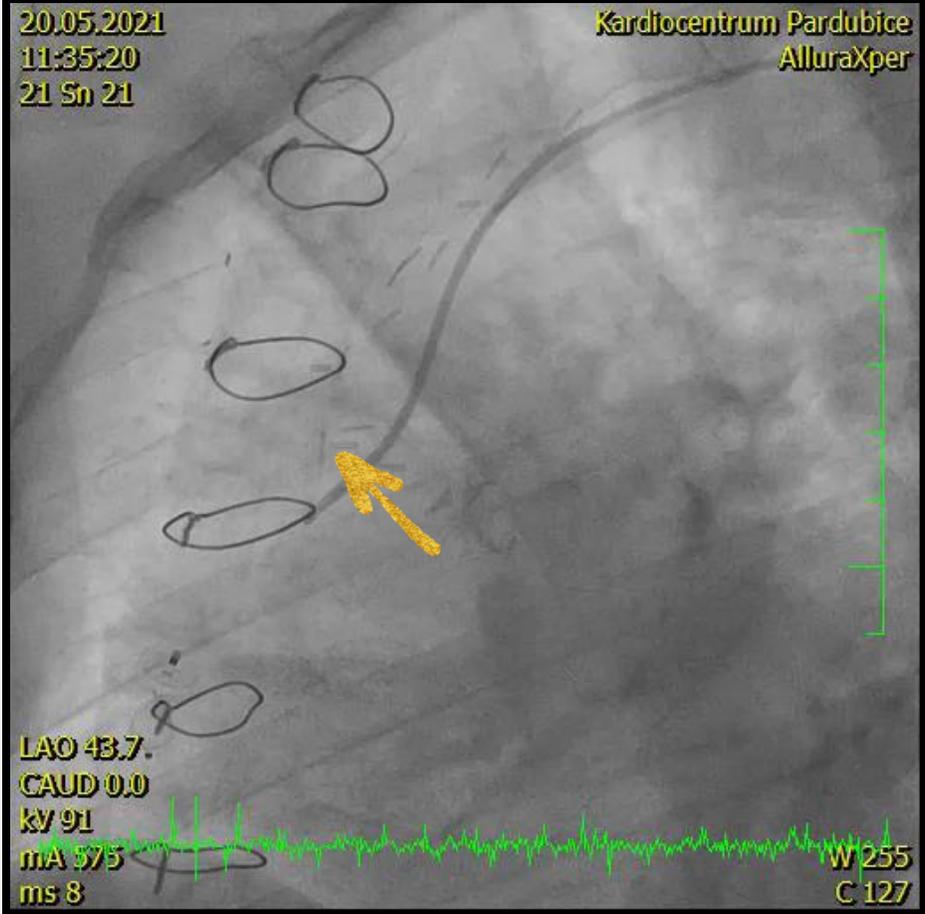
15.02.2024  
16:30:11  
116 Sn 116

Kardiocentrum Pardubice  
AlluraXper

RAO 0.2  
CAUD 28.5  
kV 87  
mA 613  
ms 8

W 255  
C 127





# Lifetime management ICHS

- přemýšlet o revaskularizaci jako o **cyklickém procesu**, nikoli jednorázovém zákroku
- **1 z 5 pacientů potřebuje opakovanou revaskularizaci do 5 let** od první procedury, častěji po PCI
- **selhání revaskularizace** (restenóza, uzávěr štěpu, progresivní nemoc v nativních tepnách) je běžným jevem
- vyžaduje dlouhodobé sledování a reintervence
- individualizovaný výběr revaskularizační modality s ohledem na:
  1. očekávanou **životnost štěpů/stentů**
  2. **věk a očekávanou délku života pacienta**
- 1. možnost **budoucí reintervence**

# Hybridní revaskularizace

- MIDCAB-LAD + PCI zbytku řečiště
- jen ~0,1 % všech CABG

Typ dat/studie	Zjištění
Registr NCDR CathPCI (Lowenstern et al. 2019)	vyšší výskyt krvácení, renálního selhání, infarktu myokardu a srdečního selhání při hybridní revaskularizaci oproti PCI samotné
RCT (Ganyukov et al., JACC 2021)	malá RCT – <b>podobné dlouhodobé výsledky</b> mezi hybridní revaskularizací, PCI a CABG
Hybrid Coronary Revascularization Trial	<b>předčasně ukončena</b> kvůli pomalému náboru

# Jak rozhodovat v praxi?

- **anatomie**

kmen, proximální RIA, celková komplexita

- **pacient**

symptomy, křehkost, komorbidity, preference

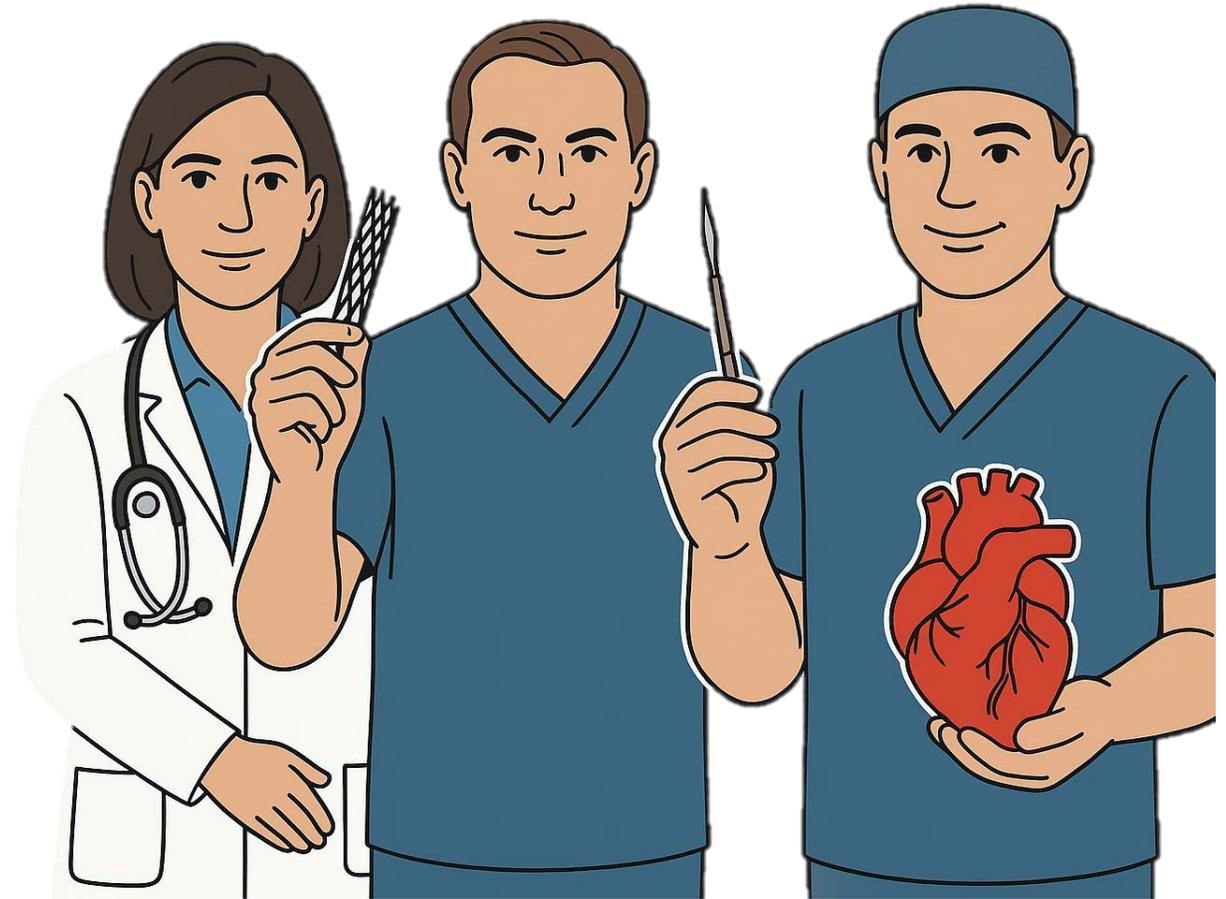
- **cíl**

symptomatická úleva vs. prognóza

- **technické možnosti**

PCI tým (včetně CHIP intervencí), kardiochirurgie

# Informovaný & sdílený rozhodovací proces



# Závěr

- guidelines ≠ realita
- **revaskularizace** pouze jedním z aspektů léčby
- **CABG** je výborná metoda – ne dokonalá, ne vždy možná
- **PCI** není „druhá liga“ – často **nejlepší možná volba**
- budíme nejen **interprety doporučení**, ale i **advokáty pacienta**



Every **STENT** you take, every **GRAFT** you make...



I'll be **WATCHING** you!