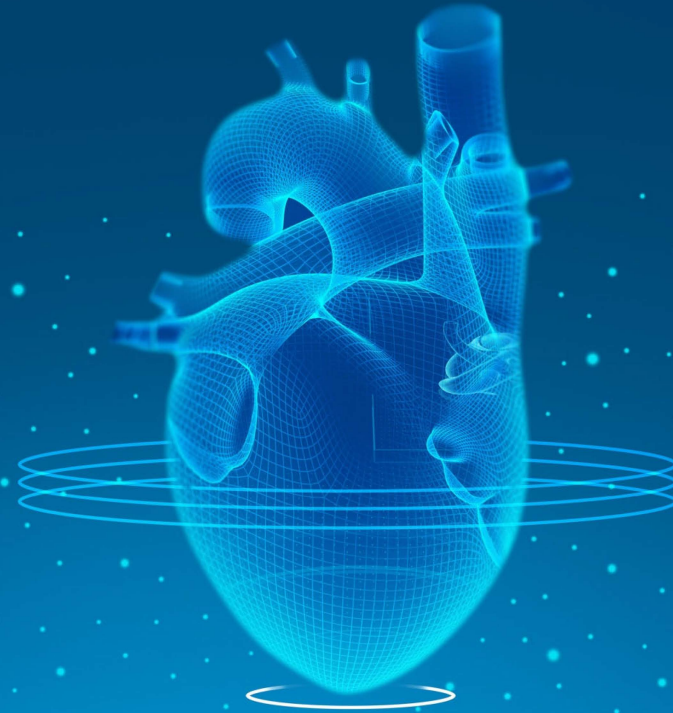




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# The 2021 Coronary Revascularization Guidelines Updates and Controversies

Madeline Mahowald, MD  
April 11, 2022



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## ACC/AHA/SCAI CLINICAL PRACTICE GUIDELINE

### **2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines**

Jennifer S. Lawton, MD, FAHA, Chair, Jacqueline E. Tamis-Holland, MD, FAHA, FACC, FSCAI, Vice Chair, Sripal Bangalore, MD, MHA, FACC, FAHA, FSCAI, Eric R. Bates, MD, FACC, FAHA, Theresa M. Beckie, PhD, FAHA, James M. Bischoff, MEd, John A. Bittl, MD, FACC, Mauricio G. Cohen, MD, FACC, FSCAI, J. Michael DiMaio, MD, Creighton W. Don, MD, PhD, FACC, Stephen E. Fremes, MD, FACC, Mario F. Gaudino, MD, PhD, MSCE, FACC, FAHA, Zachary D. Goldberger, MD, FACC, FAHA, Michael C. Grant, MD, MSE, Jang B. Jaswal, MS, Paul A. Kurlansky, MD, FACC, Roxana Mehran, MD, FACC, Thomas S. Metkus Jr, MD, FACC, Lorraine C. Nnacheta, DrPH, MPH, Sunil V. Rao, MD, FACC, Frank W. Sellke, MD, FACC, FAHA, Garima Sharma, MD, FACC, Celina M. Yong, MD, MBA, MSc, FSCAI, FACC, FAHA, and Brittany A. Zwischenberger, MD



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## Objectives

1. List Class I indications for revascularization
2. Describe findings from the ISCHEMIA trial and how results influenced guidelines
3. Highlight changes in class of recommendation



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## Replaces the following ACC/AHA guideline documents

- Replace/retire 2011 PCI guidelines
- Replace/retire 2011 CABG guidelines
- Replace/retire sections of 2012 SIHD guidelines
- Replace/retire sections of 2013 STEMI guidelines
- Replace/retire sections of 2014 NSTEMI-ACS guidelines
- Replace/retire 2015 update in PCI in STEMI guidelines



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## Outline

### Acute coronary syndromes

- STEMI
- Non-STEACS

### Stable ischemic heart disease/chronic coronary syndromes

- EF  $\leq$  35%
- EF  $>$  35%
- Left main

### Technical considerations

- PCI
- CABG



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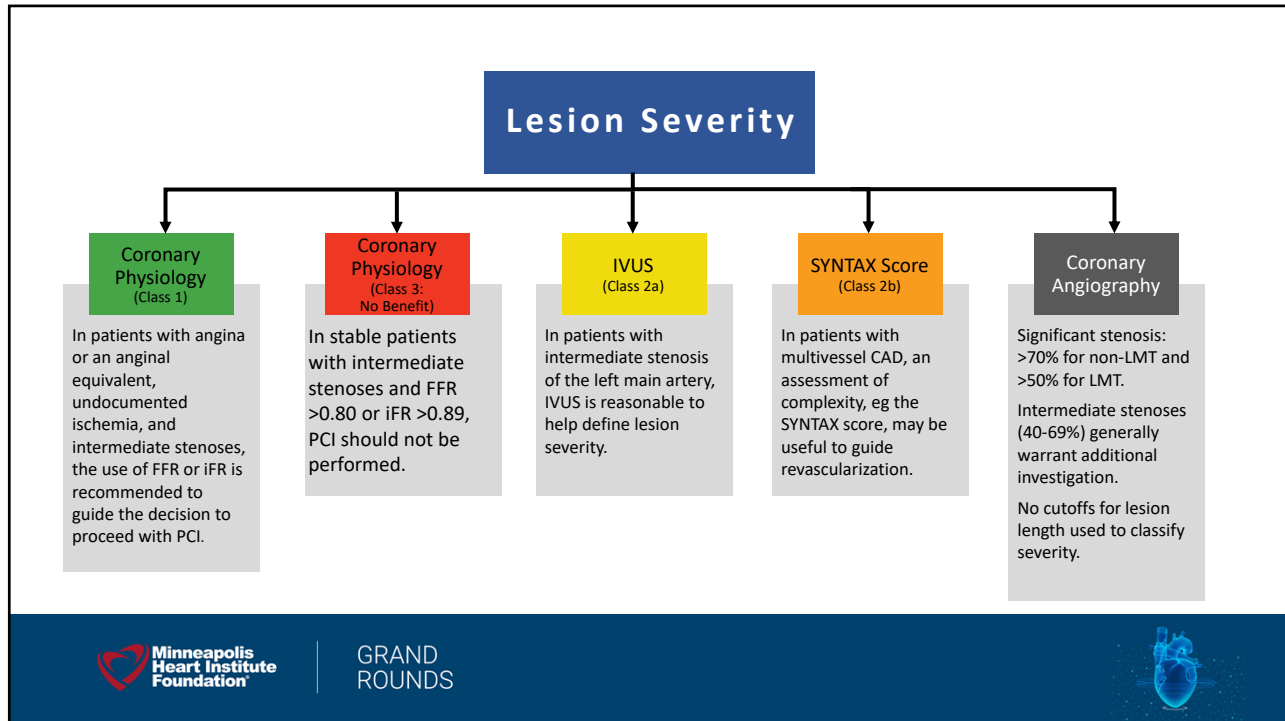
# Defining Lesion Severity



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# Revascularization in Acute Coronary Syndromes

Minneapolis Heart Institute Foundation | GRAND ROUNDS


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## Revascularization of Infarct Artery in STEMI to Improve Survival/Clinical Outcomes


**Patient with STEMI**

← PCI if...      CABG if... →

<ul style="list-style-type: none"> <li>• ischemic symptoms for &lt;12 hr (1)</li> <li>• failed reperfusion after lytics, then rescue PCI (1)</li> <li>• cardiogenic shock or hemodynamic instability (1)</li> </ul>	<ul style="list-style-type: none"> <li>• mechanical complications:                             <ul style="list-style-type: none"> <li>– ventricular septal rupture</li> <li>– papillary muscle infarction or rupture</li> <li>– free wall rupture (1)</li> </ul> </li> <li>• cardiogenic shock or hemodynamic instability (1)</li> </ul>
<ul style="list-style-type: none"> <li>• 3-24 hr after lytics with PCI intent (2a)</li> <li>• stable &amp; 12 to 24 hr after symptom onset (2a)</li> <li>• ongoing ischemia, HF, or arrhythmia (2a)</li> </ul>	<p>If PCI is not feasible or successful, with a large area of myocardium at risk (2a)</p>
<p>Asymptomatic stable STEMI w/ total occlusion &gt;24 hr after symptom onset &amp; no severe ischemia, PCI should not be performed. (3:No Benefit)</p>	<p>Emergency CABG should <b>NOT</b> be performed after failed primary PCI unless large ischemic territory and absent no-reflow state or poor distal targets. (3:Harm)</p>




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## Revascularization of Non-Infarct-Related Coronary Artery Lesions in STEMI


Patients without significant comorbidities with large non-infarct vessels



<p>In selected hemodynamically stable patients with STEMI and ...</p>	<p>multivessel disease, after successful primary PCI, staged PCI of a significant non-infarct artery stenosis <u>is recommended</u>. (Class 1)</p>	<p>low-complexity multivessel disease, PCI of a non-infarct artery stenosis <u>may be considered</u> at time of primary PCI to reduce cardiac events. (Class 2b)</p>
<p>In STEMI...</p>	<p>in selected patients with complex multivessel non-infarct artery disease, after successful primary PCI, elective CABG <u>is reasonable</u>. (Class 2a)</p>	<p>complicated by cardiogenic shock, routine PCI of a non-infarct artery at time of primary PCI should <b>NOT</b> be performed due to higher risk of death or renal failure. (Class 3:Harm)</p>



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## 2013 ACCF/AHA Guidelines for Management of STEMI

	COR	LOE	References
Ischemic symptoms <12 h	I	A	(82,208,209)
Ischemic symptoms <12 h and contraindications to fibrinolytic therapy irrespective of time delay from FMC	I	B	(210,211)
Cardiogenic shock or acute severe HF irrespective of time delay from MI onset	I	B	(212-215)
Evidence of ongoing ischemia 12 to 24 h after symptom onset	IIa	B	(94,95)
PCI of a noninfarct artery at the time of primary PCI in patients without hemodynamic compromise	III: Harm	B	(216-218)

IIb  
 COMPLETE trial

O'Gara PT, et al. *Circulation*, 2013.

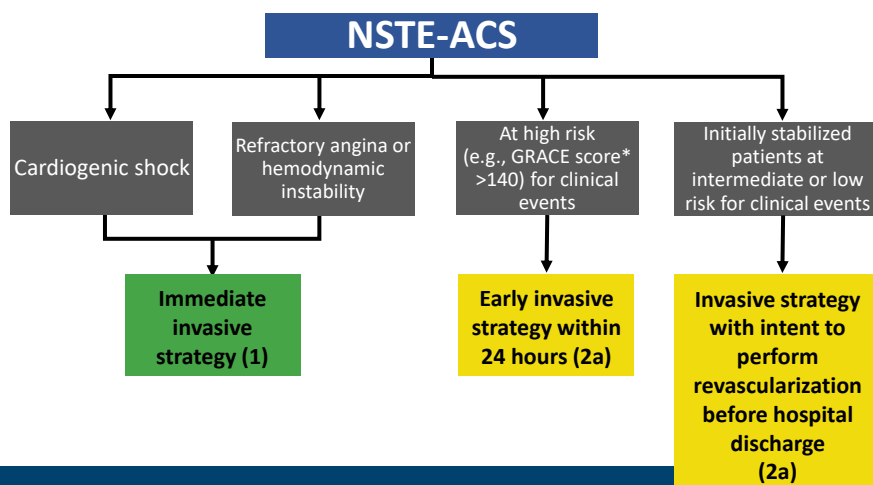


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## Timing of Invasive Strategy in NSTEMI-ACS



**Guiding Principle:**  
 Revascularization in the context of NSTEMI-ACS should consider clinical stability, risk of recurrent event(s), coronary anatomy, and degree of myocardium at risk.



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**2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: The Task Force for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation of the European Society of Cardiology (ESC)** <sup>FREE</sup>

An early invasive strategy within 24 h is recommended in patients with any of the following high-risk criteria:

- Diagnosis of NSTEMI.
- Dynamic or presumably new contiguous ST/T-segment changes suggesting ongoing ischaemia.
- Transient ST-segment elevation.
- GRACE risk score >140.

A selective invasive strategy after appropriate ischaemia testing or detection of obstructive CAD by CCTA is recommended in patients considered at low risk.

Collet JP, et al. *Eur Heart J*, 2021.

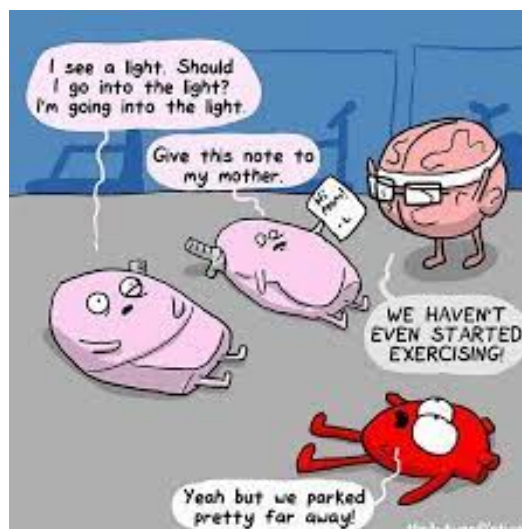


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# Revascularization in Stable Ischemic Heart Disease

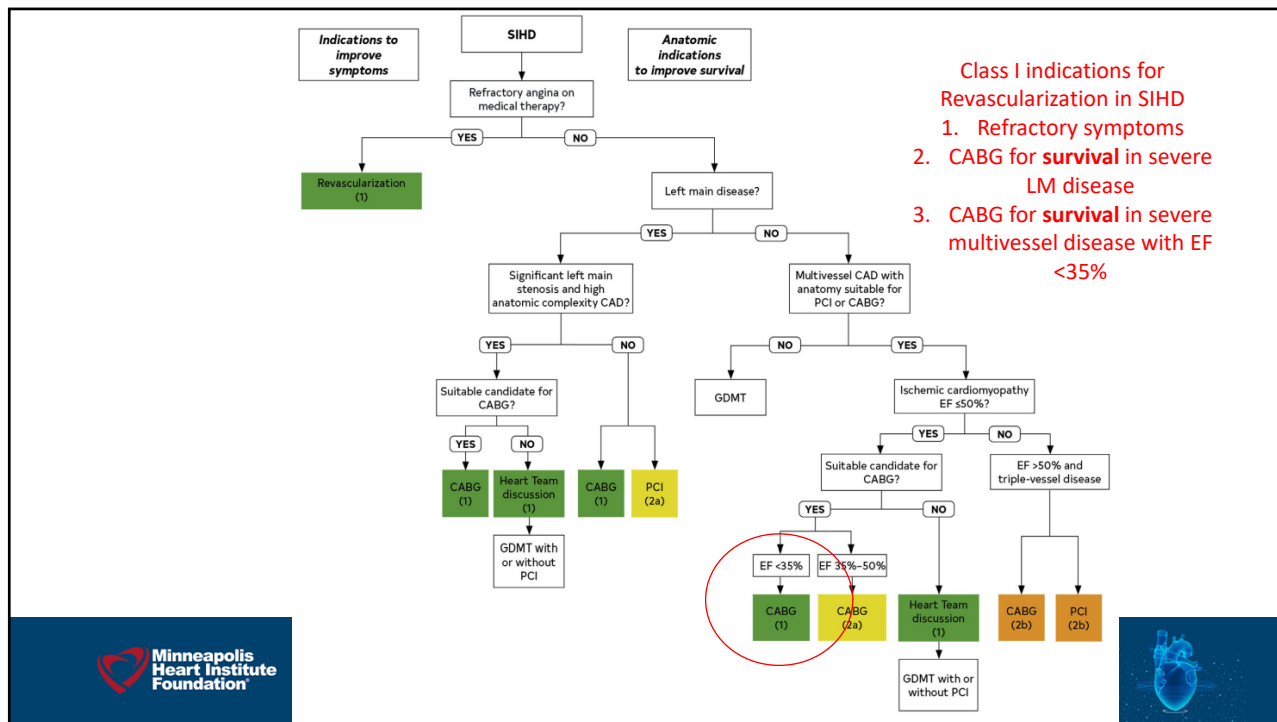


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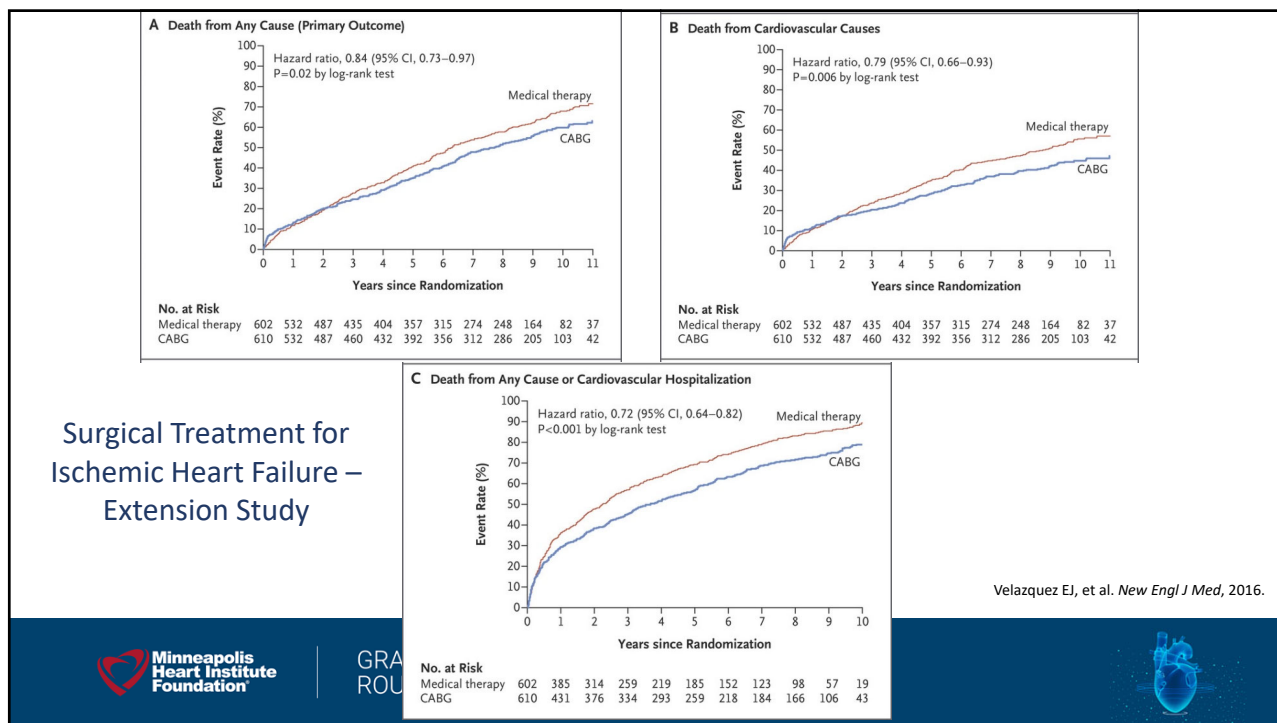


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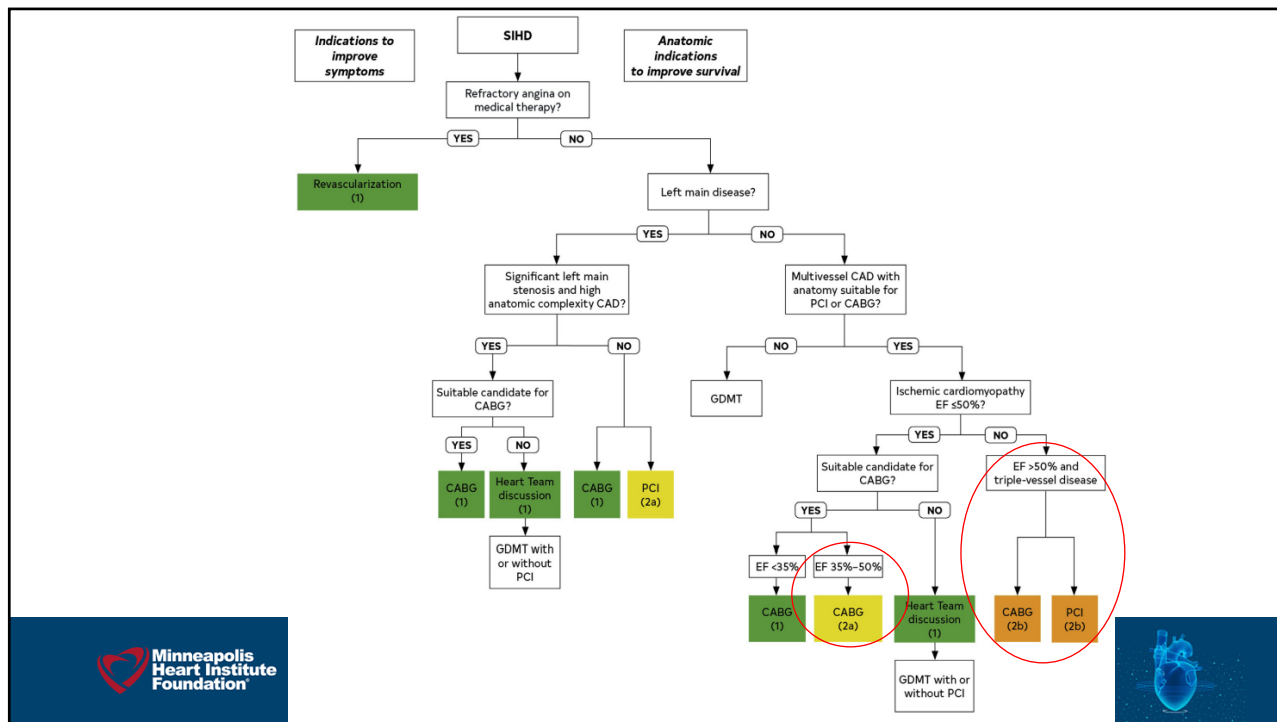




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## International Study of Comparative Health Effectiveness with Medical and Invasive Approaches

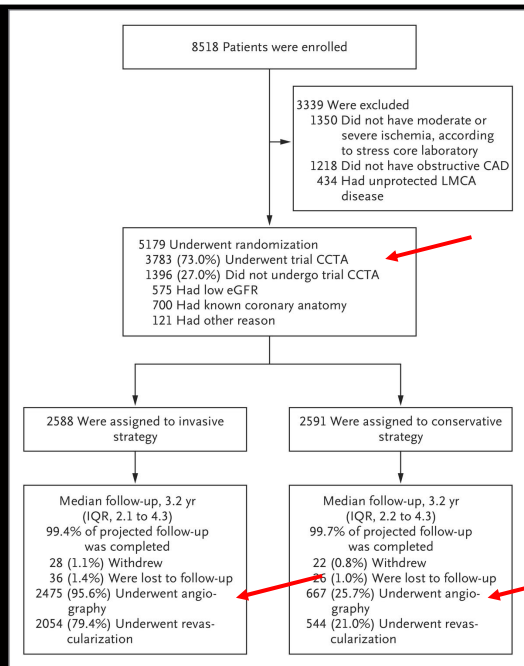
- At least moderate-severe ischemia on stress tests with imaging or severe ischemia on exercise stress tests
- Primary outcome: composite of CV death, MI, or hospitalization for UA, HF, or resuscitated cardiac arrest
- Secondary outcomes: composite of CV death or MI, angina-related QOL
- Exclusion criteria
  - Recent ACS
  - CKD (eGFR<30)
  - Stage III-IV HF
  - Medically refractory angina
  - Unprotected left main disease

Maron DJ, et al. *New Engl J Med*, 2020.

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**Initial Invasive or  
 Conservative Strategy  
 for Stable Coronary  
 Disease**

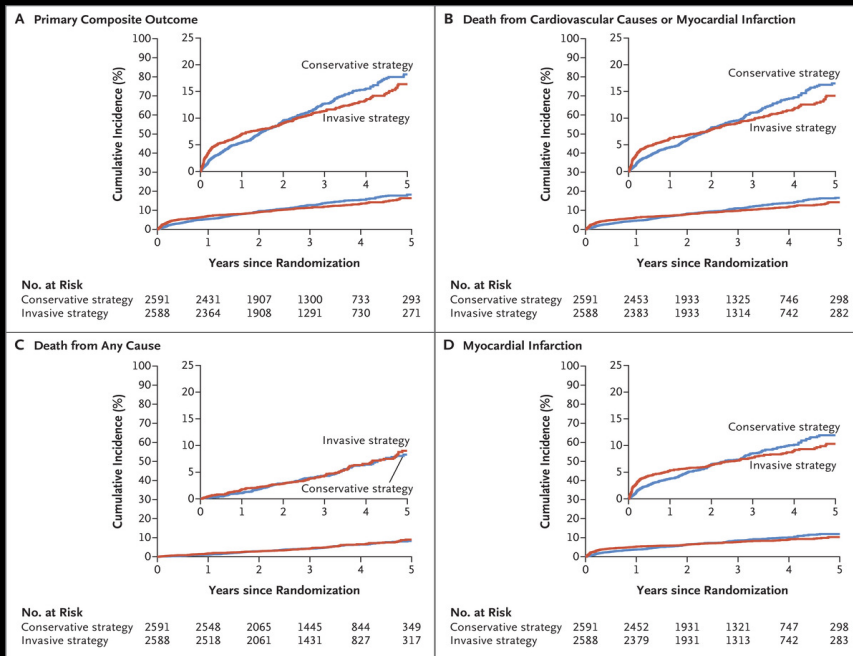


DJ Maron et al. N Engl J Med 2020;382:1395-1407.



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**Time-to-Event  
 Curves for the  
 Primary Composite  
 Outcome and Other  
 Outcomes.**



DJ Maron et al. N Engl J Med 2020;382:1395-1407.



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## Revascularization Approach to Reduce Cardiovascular Events in SIHD Compared with Medical Therapy

COR	RECOMMENDATIONS
2a	In patients with SIHD and multivessel CAD appropriate for either CABG or PCI, revascularization is reasonable to lower the risk of cardiovascular events such as spontaneous MI, unplanned urgent revascularizations, or cardiac death.

## Revascularization Approach to Improve Symptoms

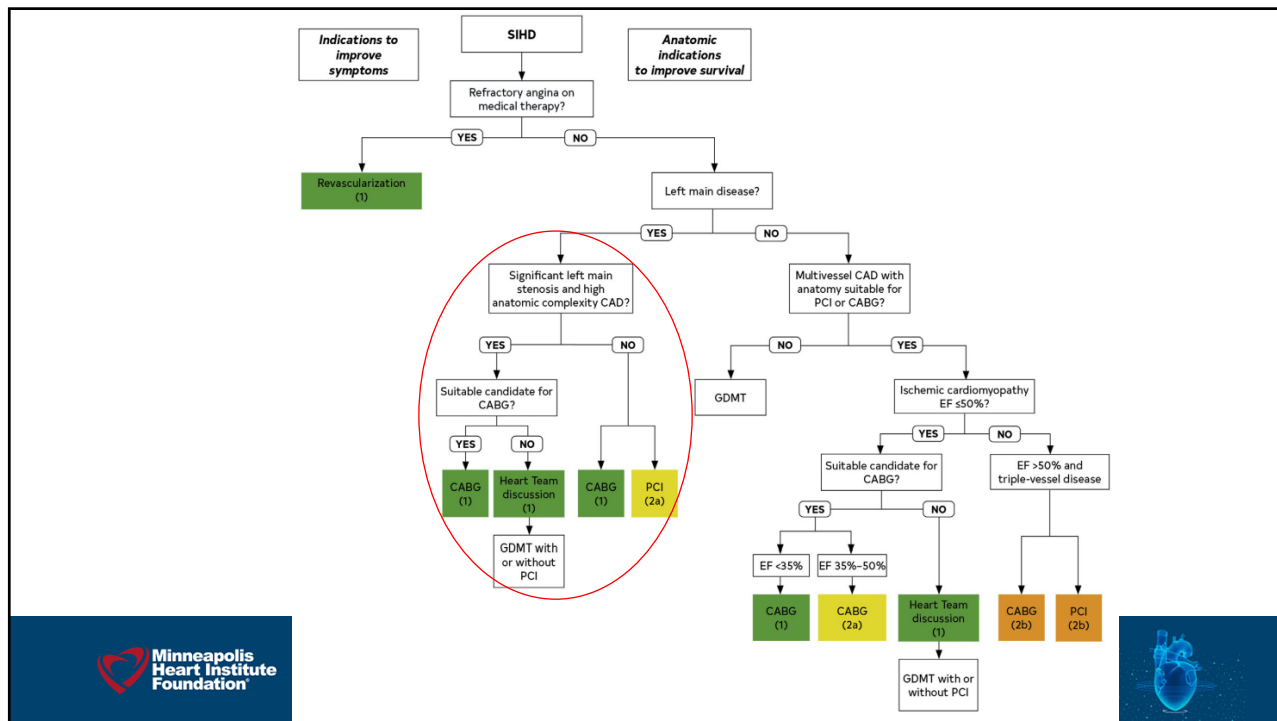
COR	RECOMMENDATIONS
1	In patients with refractory angina despite medical therapy and with significant coronary artery stenoses amenable to revascularization, revascularization is recommended to improve symptoms.



**Abbreviations:** CABG indicates coronary artery bypass grafting; EF, ejection fraction; LAD, left anterior descending artery; LVEF, left ventricle ejection fraction; PCI, percutaneous coronary intervention; and SIHD, stable ischemic heart disease.

Lawton, J. S. et al. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization. *Circulation*.

21



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**Left main CAD**

1	B-R	3. In patients with SIHD and significant left main stenosis, CABG is recommended to improve survival (9-12).
2a	B-NR	4. In selected patients with SIHD and significant left main stenosis for whom PCI can provide equivalent revascularization to that possible with CABG, PCI is reasonable to improve survival (9).

The diagram shows a central black circle labeled "Complex" surrounded by six light blue circles, each containing a feature: Severe tortuosity, Heavy calcium, Complex bifurcation, Trifurcation lesion, Aorto-ostial stenosis, and Thrombus.

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**A 0-5 years**

	0	1	2	3	4	5
CABG	2197	2085	2042	2002	1939	1585
PCI	2197	2120	2068	2015	1942	1539

**Meta-analysis of NOBLE, EXCEL, PRECOMBAT, SYNTAX**

“...among patients with LM CAD that had **low-to-intermediate coronary anatomical complexity**, there was no statistically significant difference in long-term mortality between PCI and CABG, although a Bayesian approach suggested a difference favouring CABG probably exists, which is more likely than not less than 0.2% per year.”

Sabatine MS, et al. *Lancet*, 2021.

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# Procedural Considerations in PCI



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## General Procedural Issues for PCI: *Procedure Considerations*

### Vascular Access

PCI in ACS

PCI in SIHD

Radial Approach (I)

↓30-day rates:

Death  
Non-fatal MI and  
CVA  
Non-major  
bleeding

↓30-day rates:

Bleeding  
Vascular  
complications

### Stent Selection

DES should be used in  
preference to BMS  
(Class I)

Significant reduction in:  
MI  
Restenosis  
Acute stent thrombosis

### Intravascular Imaging

IVUS,OCT can be useful for  
guidance (2a)

LM/complex coronary  
stenting  
Mechanism of stent failure  
Lesion preparation  
Stent sizing and expansion  
Evaluate complications

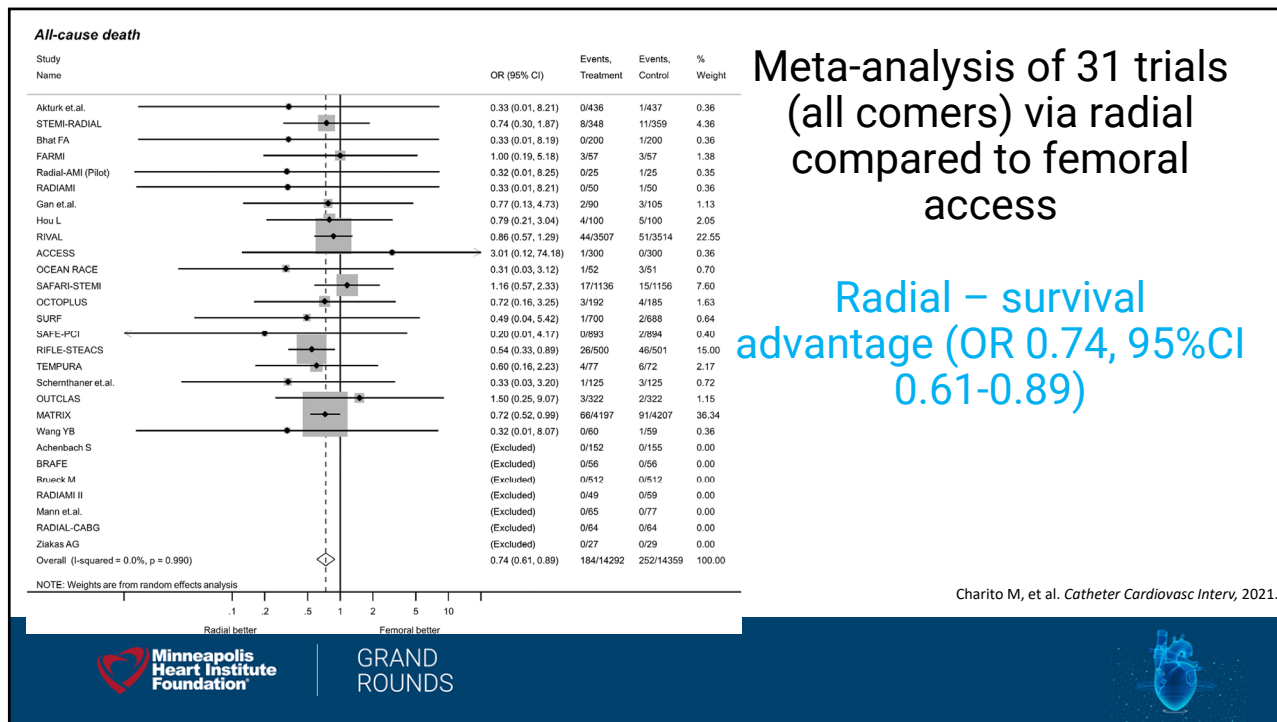
Compared with angiographic-  
guided PCI at 3 years, decreased  
MACE, TVR, TLR



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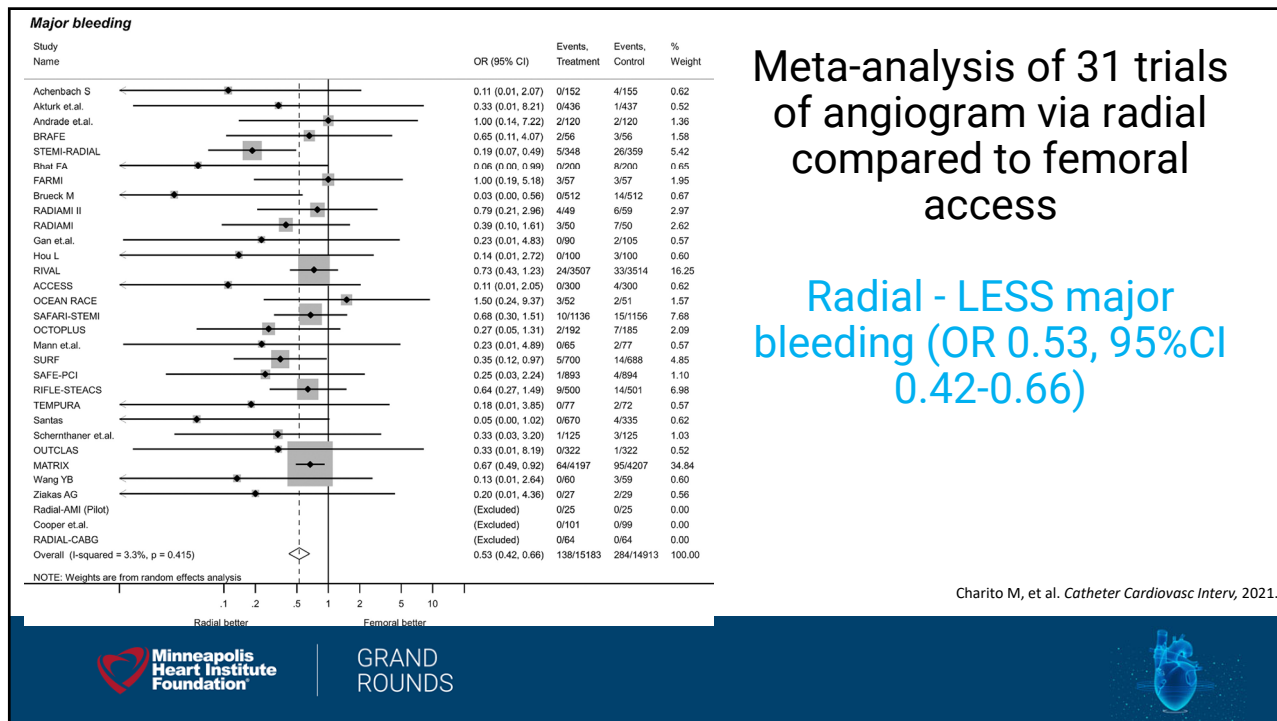
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Meta-analysis of 31 trials (all comers) via radial compared to femoral access

Radial – survival advantage (OR 0.74, 95%CI 0.61-0.89)

27

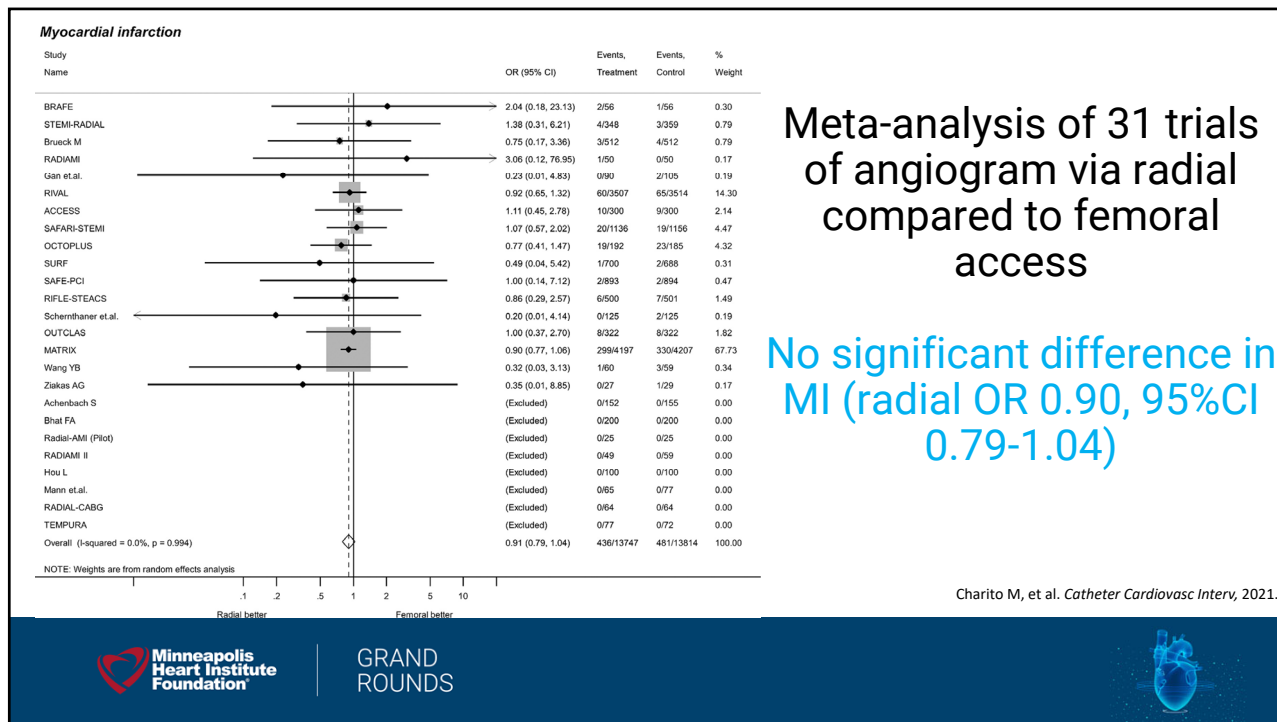


Meta-analysis of 31 trials of angiogram via radial compared to femoral access

Radial - LESS major bleeding (OR 0.53, 95%CI 0.42-0.66)

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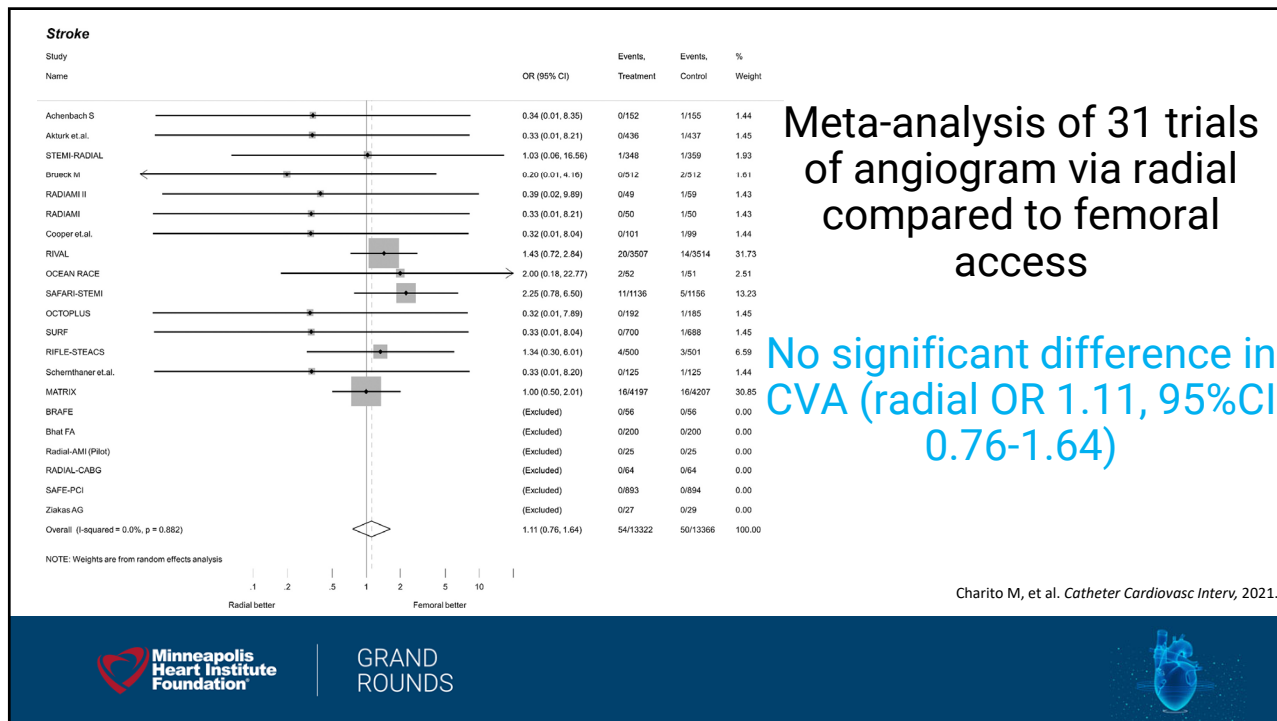




Meta-analysis of 31 trials of angiogram via radial compared to femoral access

No significant difference in MI (radial OR 0.90, 95%CI 0.79-1.04)

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Meta-analysis of 31 trials of angiogram via radial compared to femoral access

No significant difference in CVA (radial OR 1.11, 95%CI 0.76-1.64)

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## General Procedural Issues for PCI: Hemodynamic Support

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## General Procedural Issues for PCI

### Hemodynamic Support

COR	RECOMMENDATIONS
2b	Elective placement of a hemodynamic support device, such as Impella or IABP, may be reasonable as an adjunct to PCI in select high-risk patients

RCT showed no benefit in the composite outcome of death, MI, CVA or repeat revascularization



**Abbreviations:** CTO indicates chronic total occlusion; CVA, stroke; IABP, intra-aortic balloon pump; MI, myocardial infarction; PCI, percutaneous coronary intervention; QOL, quality of life; and RCT, randomized controlled trial.

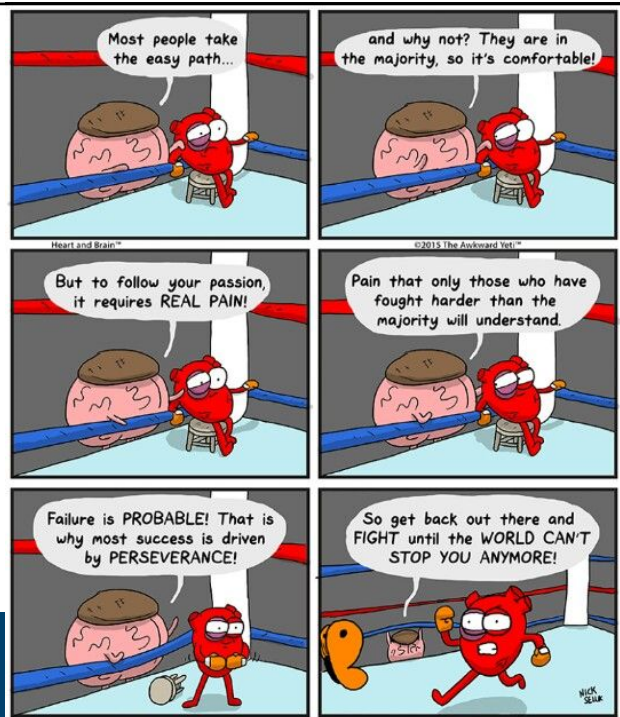
Lawton, J. S. et al. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization. *Circulation*.

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# Chronic Total Occlusions



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## Chronic Total Occlusions

### 2011 ACCF/AHA/SCAI Guidelines for PCI

“PCI of a CTO in patients with appropriate clinical indications and suitable anatomy is reasonable when performed by operators with appropriate expertise.” (Class 2a)

### Current Guidelines

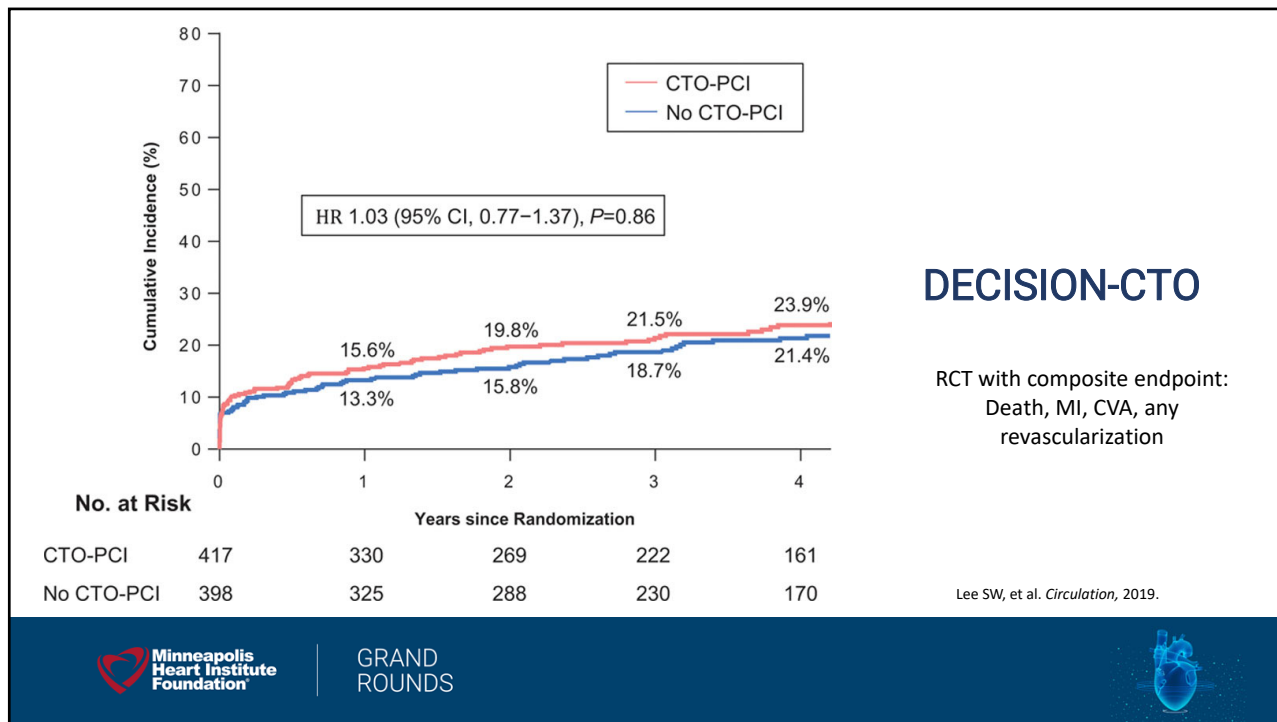
“In patients with suitable anatomy who have refractory angina on medical therapy, after treatment of non-CTO lesions, the benefit of PCI of a CTO to improve symptoms is uncertain.” (Class 2b)



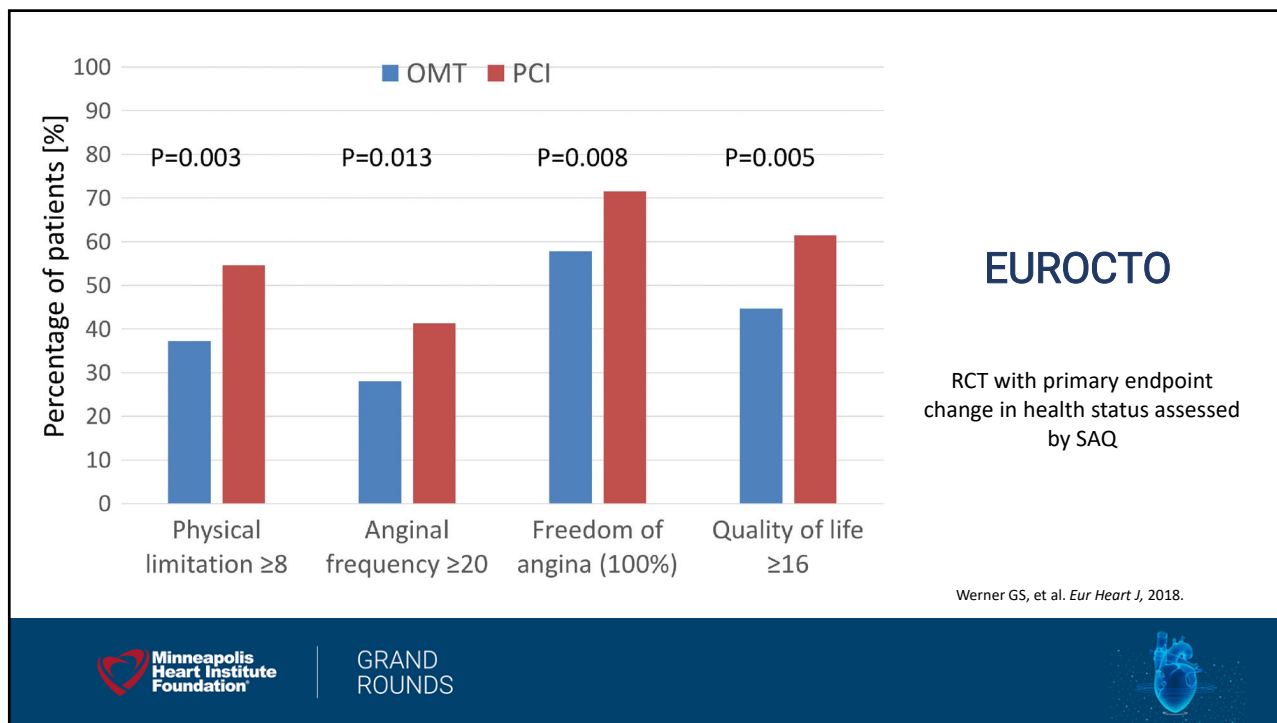
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**CENTRAL ILLUSTRATION: Left Ventricular Function at 4-Month Follow-Up in STEMI Patients Undergoing CTO PCI Versus no CTO PCI**

Parameter	CTO-PCI (n=136)	No CTO-PCI (n=144)	p-value
Left Ventricular Ejection Fraction (%)	~44	~45	0.597
Left Ventricular End Diastolic Volume (ml)	~215	~210	0.703

Henriques, J.P.S. et al. *J Am Coll Cardiol.* 2016;68(15):1622-32.

EXPLORE

RCT in patients after primary PCI for STEMI: primary endpoint was change in LV function/dimension

Henriques JPS, et al. *J Amer Coll Cardiol*, 2016.

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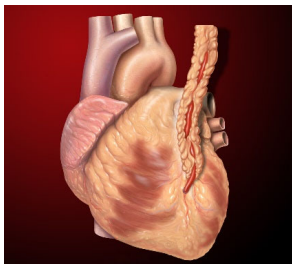
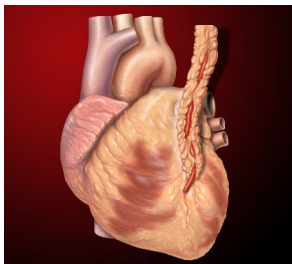
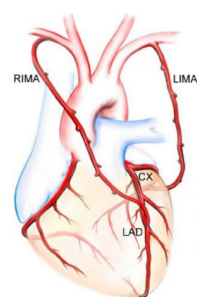
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# Procedural Considerations in CABG

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## Bypass Conduits in Patients Undergoing CABG

Radial artery	IMA (prefer left)	BIMA
<p>Recommended in preference to a saphenous vein conduit to graft the second most important, significantly stenosed, non-LAD vessel (Class 1)</p>	<p>To LAD (Class 1)</p>	<p>Improves long-term outcomes when procedure is done by experienced operators (Class 2a)</p>
		

**Abbreviations:** BIMA indicates bilateral internal mammary artery; IMA, internal mammary artery; LAD, left anterior descending; and SVG, saphenous vein graft..

Lawton, J. S. et al. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization. *Circulation*.



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**NEWS • Daily News**



# Surgeon Groups Explain Why They Didn't Endorse AATS and STS coronary revascularisation guidelines

13th January 2022 2307

With three primary grievances, plus representation issues, AATS and STS are seeking changes to guideline-writing processes.

## What do the surgical groups think?

### Surgical Groups Push Back Against Revascularization Guidelines



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### Objection #1

- Class of recommendation downgrade from I to IIb for CABG to improve survival for 3v CAD and preserved EF
- Class of recommendation downgrade from I to IIa for CABG to improve survival for 3v CAD with mild-mod reduced EF

2b	B-R	5. In patients with SIHD, normal ejection fraction, significant stenosis in 3 major coronary arteries (with or without proximal LAD), and anatomy suitable for CABG, CABG may be reasonable to improve survival (10,13-15).
2b	B-R	6. In patients with SIHD, normal ejection fraction, significant stenosis in 3 major coronary arteries (with or without proximal LAD), and anatomy suitable for PCI, the usefulness of PCI to improve survival is uncertain (14-24).
2a	B-NR	2. In selected patients with SIHD and multivessel CAD appropriate for CABG and mild-to-moderate left ventricular systolic dysfunction (ejection fraction 35%-50%), CABG (to include a left internal mammary artery [LIMA] graft to the LAD) is reasonable to improve survival (3-8).

Sabik JF, et al. *Ann Thorac Surg*, 2021.



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COR	RECOMMENDATIONS
2a	In patients with SIHD and multivessel CAD appropriate for either CABG or PCI, revascularization is reasonable to lower the risk of cardiovascular events such as spontaneous MI, unplanned urgent revascularizations, or cardiac death.

### Objection #2

- Similar weight given to PCI and CABG for revascularization to decrease ischemic events

### Objection #3

- COR I for radial, equivalent to LIMA and higher than BIMA

Sabik JF, et al. *Ann Thorac Surg*, 2021.

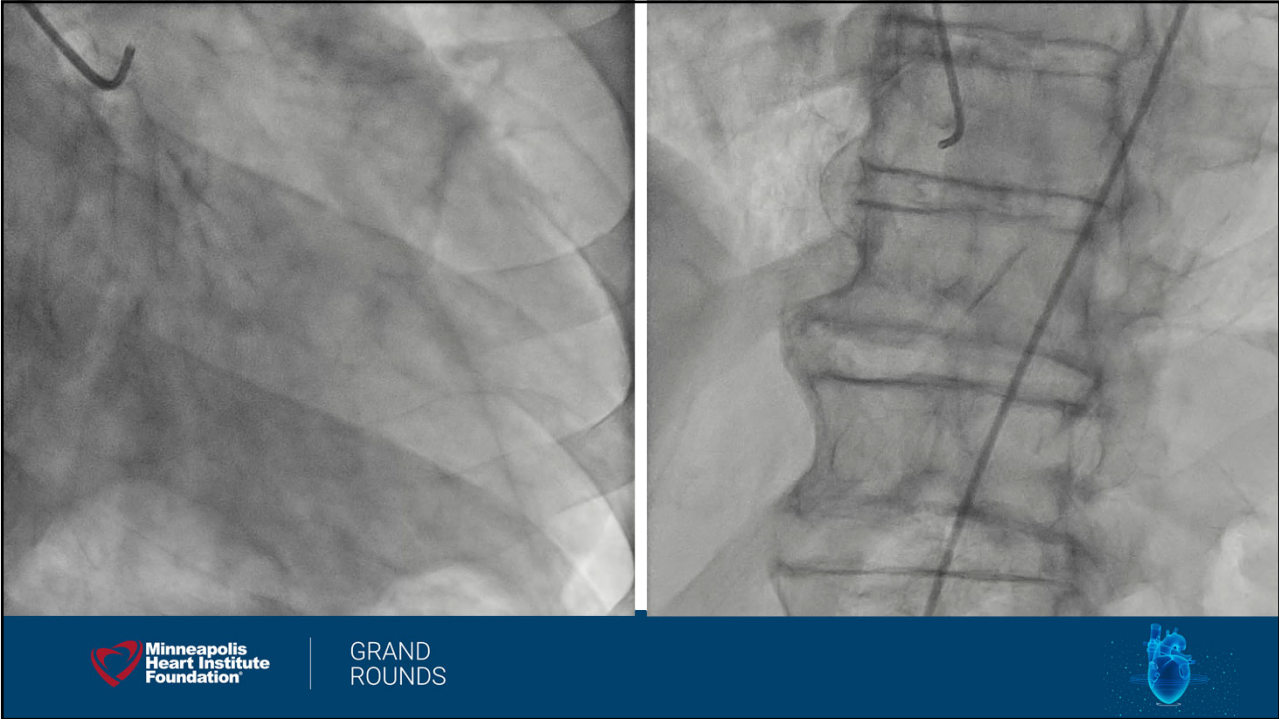


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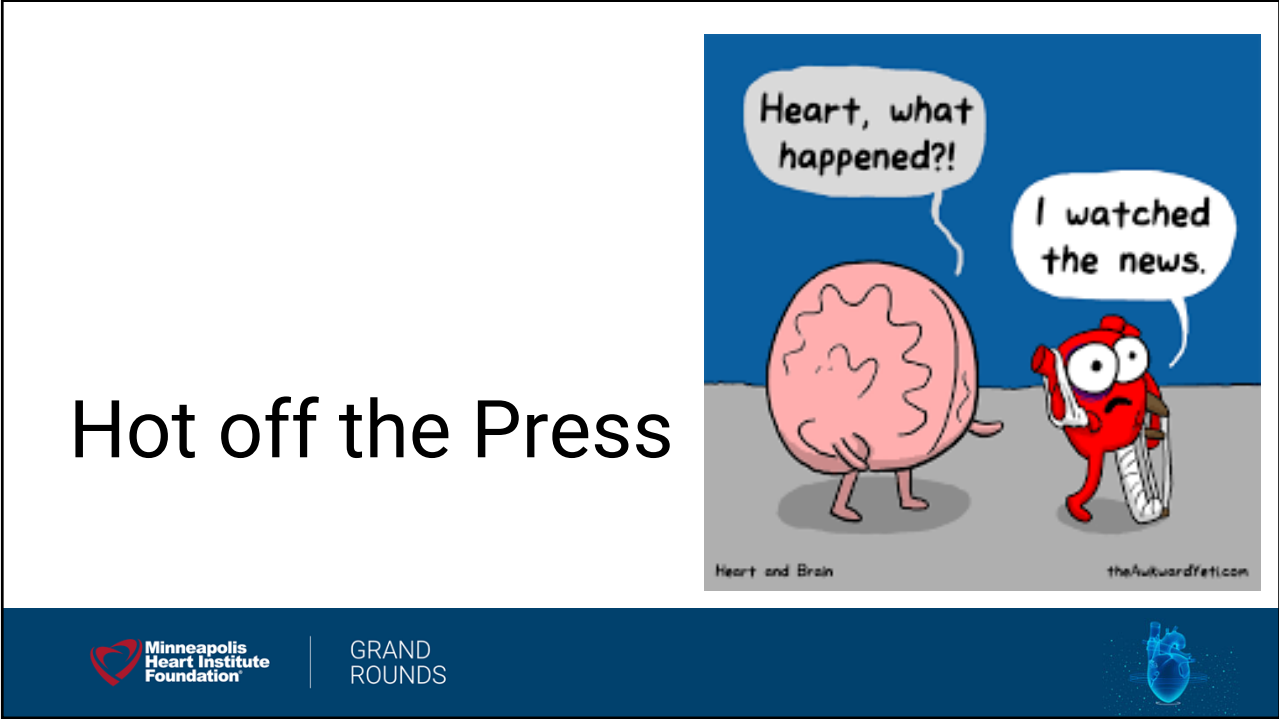


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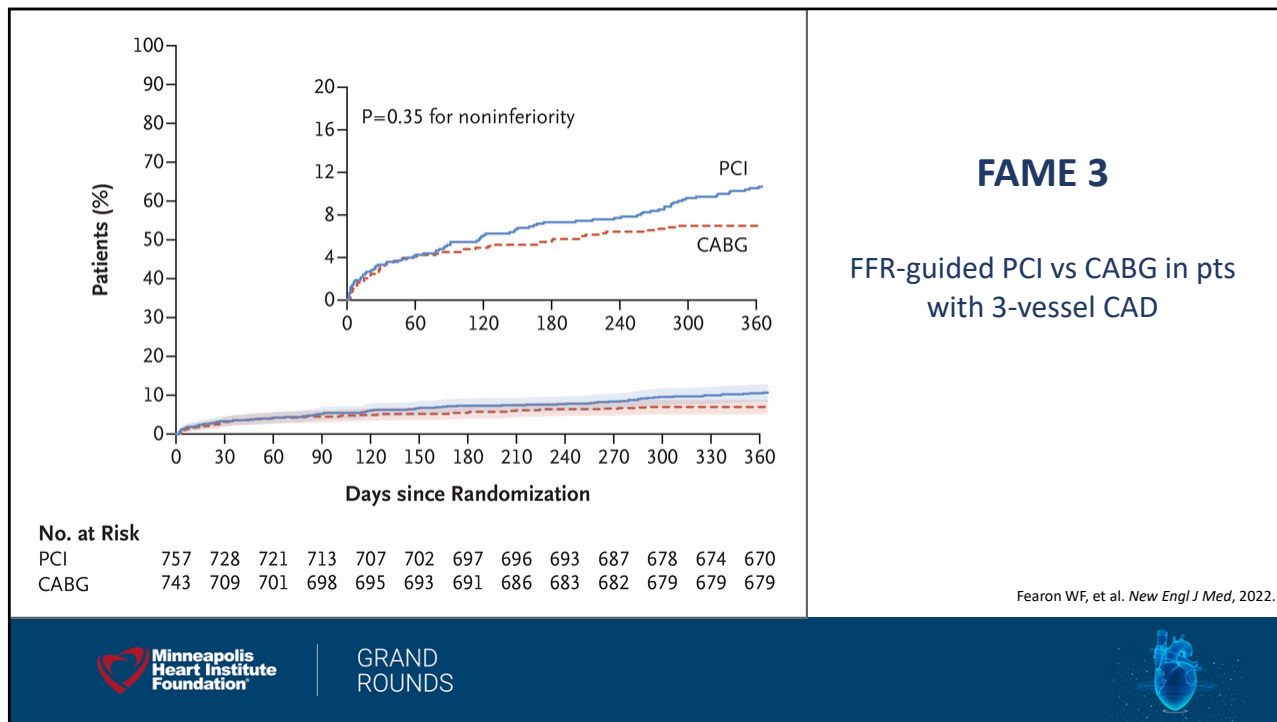




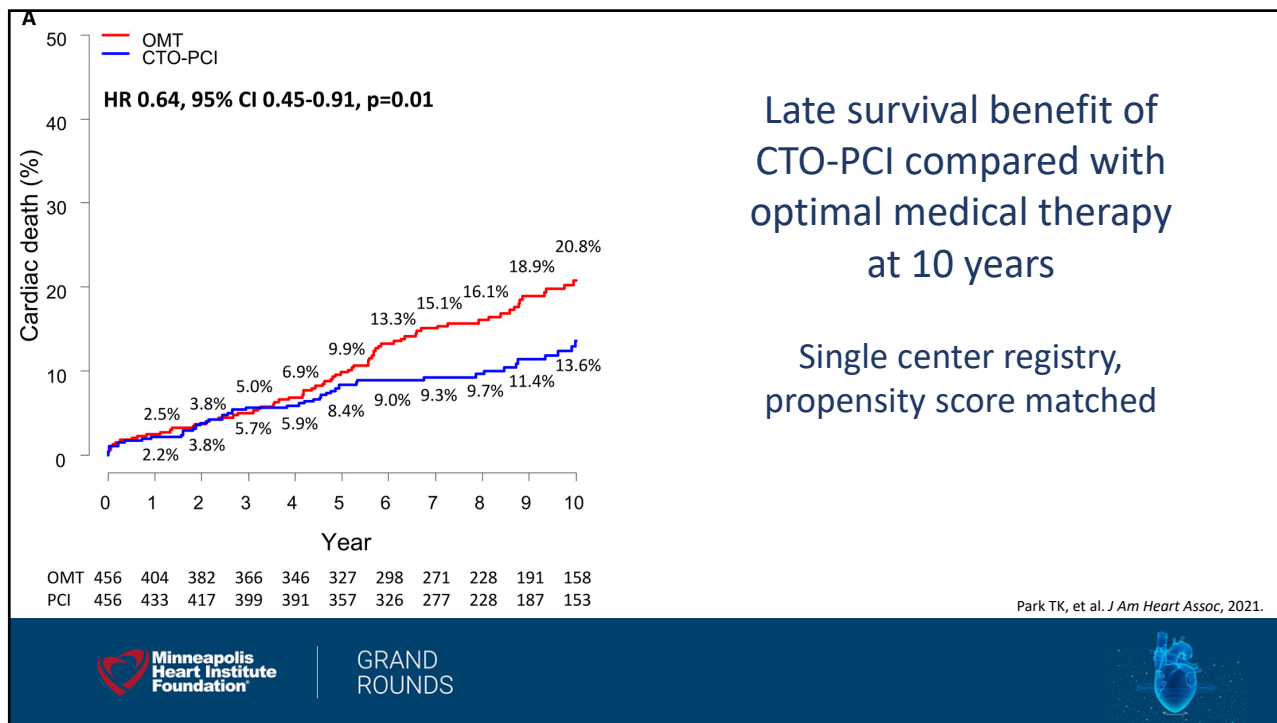
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Thank you

