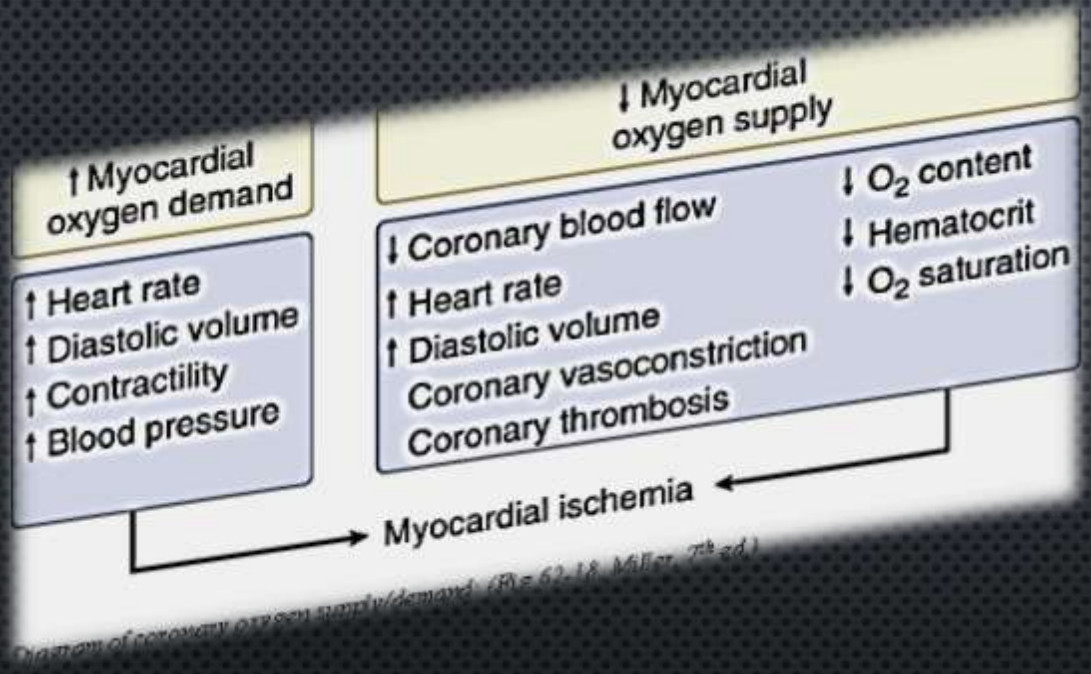
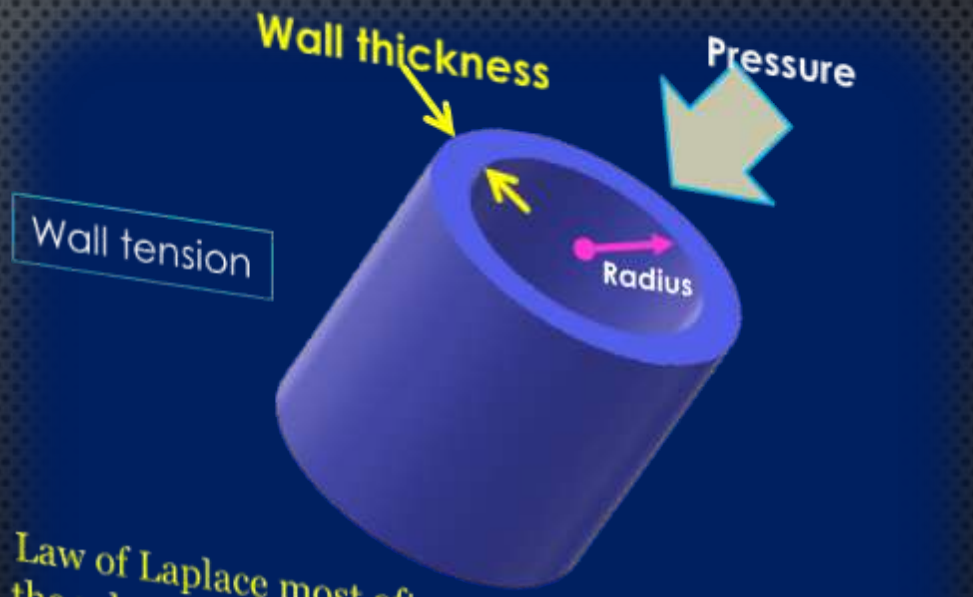
# STABLE ISCHEMIC HEART DISEASE

**MANAGEABLE WITH OPTIMAL MEDICAL TREATMENT OR REVASCULARIZATION**



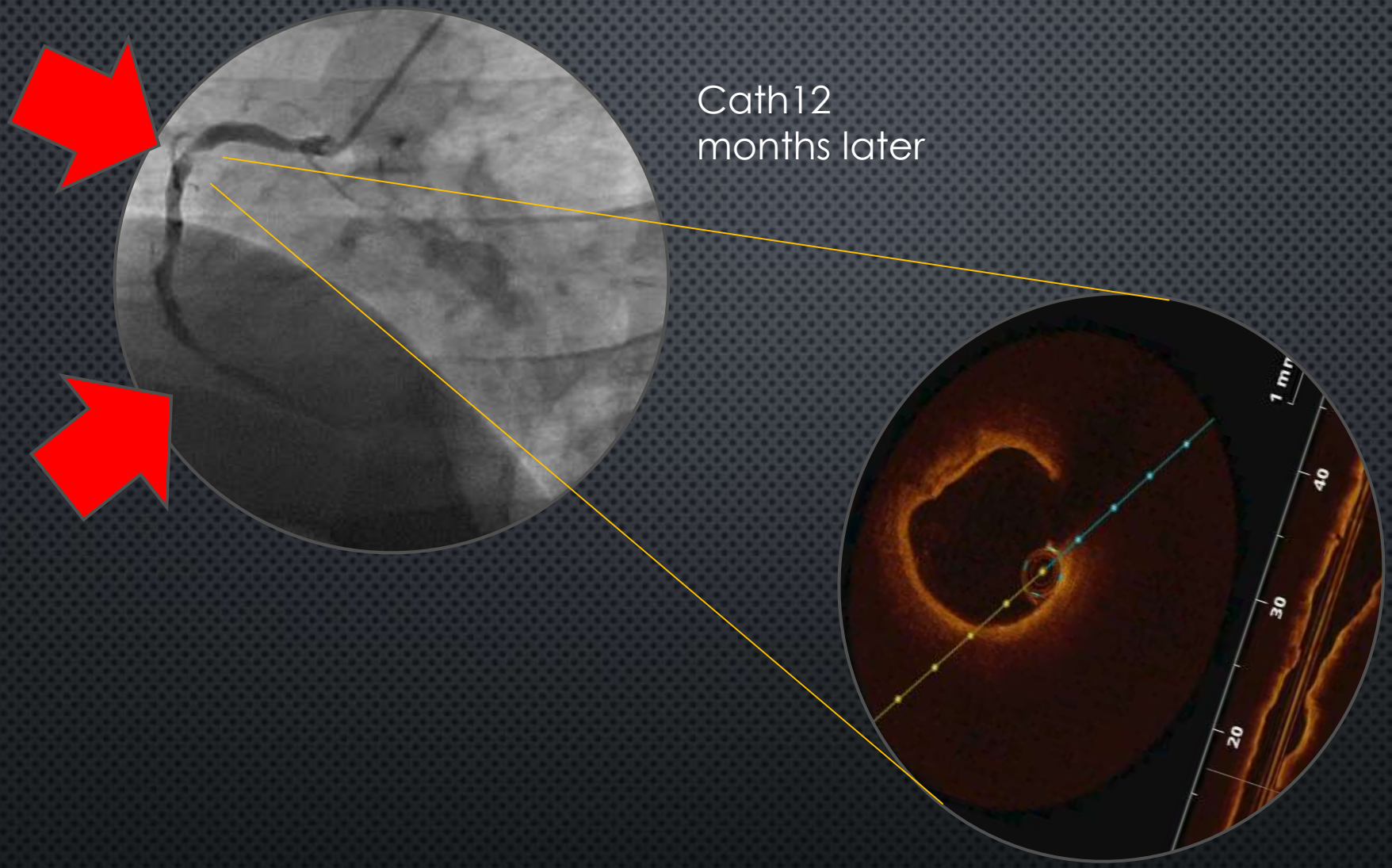




Law of Laplace most often used in hemodynamics gives the relation between transmural pressure and the stress in the wall in organs with a wall thickness $h$.

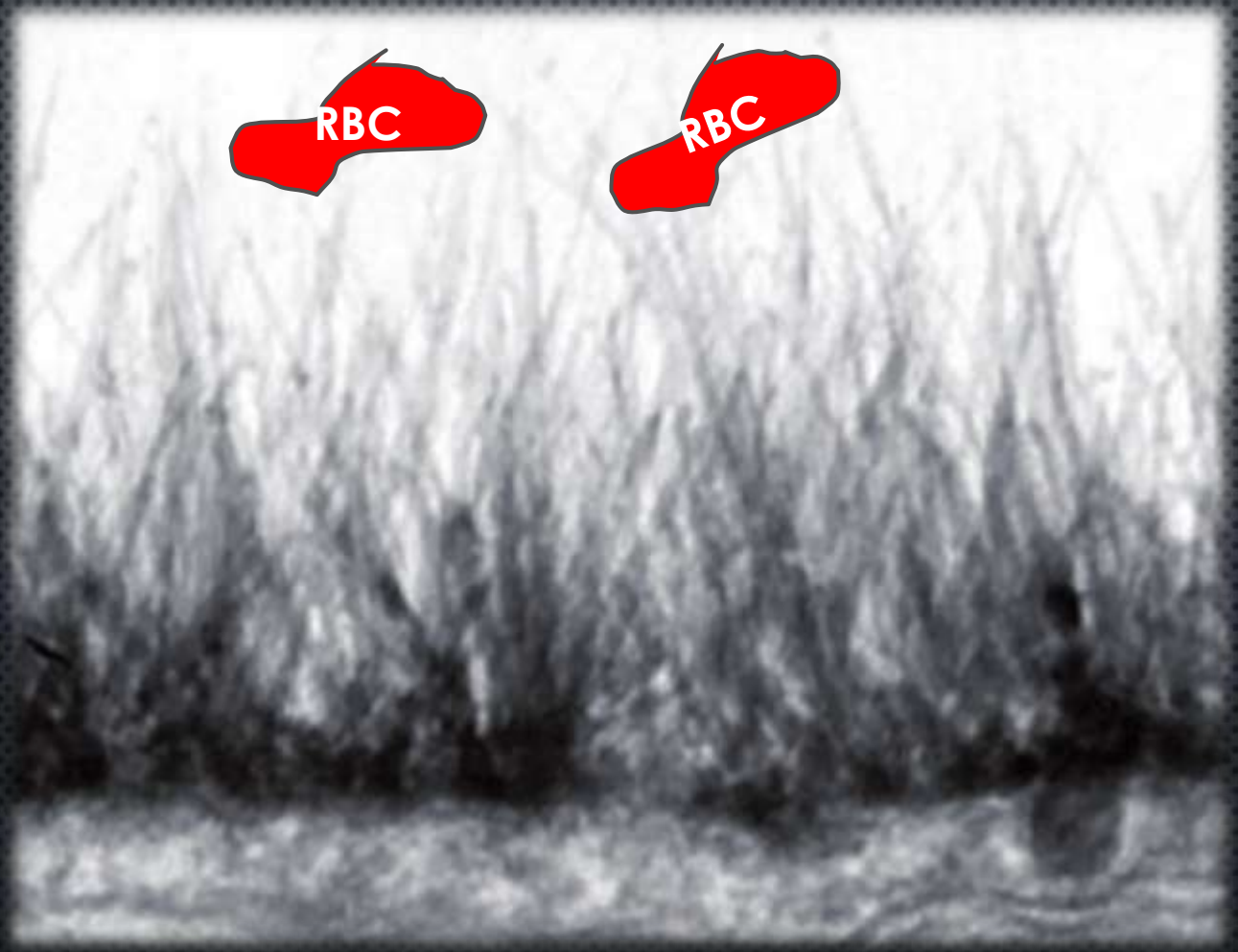
**Myocardial oxygen consumption**

# Which is the correct order of importance in reducing myocardial oxygen consumption

1. Blood pressure, heart rate and LV volume
2. Heart rate, LV size, Blood pressure
3. antiplatelet agent, LV pressure, blood pressure
4. Blood pressure, antiplatelet agent
5. Heart rate, blood pressure, LV volume


Cath12
months later
1 mm
40
30
20

Basic level: inflammation, hyperglycemia and other risk factors damage vascular lining




Glycocalyx

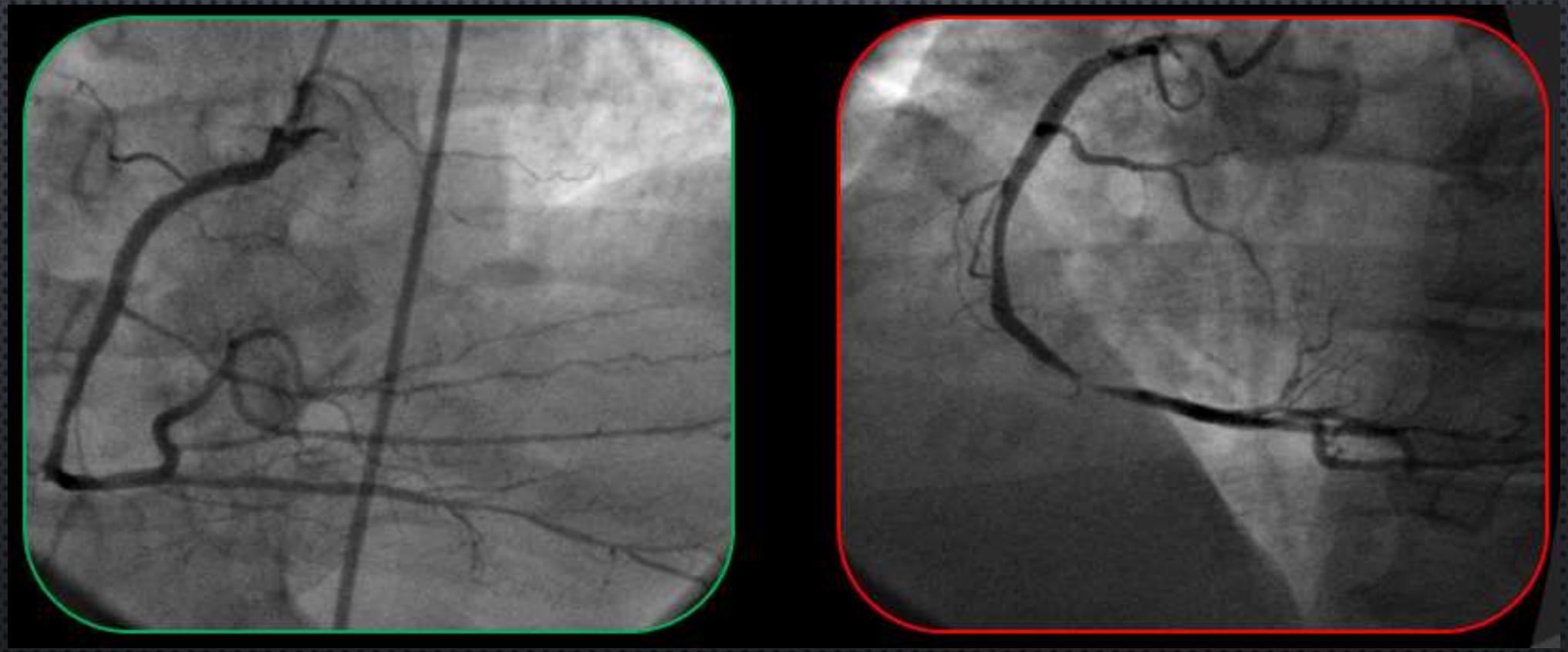
Endothelial cells

Vascular Endothelial Glycocalyx

Role of glycocalyx

- Endothelial function
- Permeability
- Coagulation-inhibit platelet adherence
- Inflammation-prevent WBC adherence
- Others

DOI: 10.1016/j.chest.2018.03.003



Supply: epicardial vessel

Demand

**HEART RATE**

Blood pressure

LV volume

Contractility

**Atherosclerosis (epicardial)**
**Or small vessel (diabetes, hypertension, other)**

# PHYSICAL EXAM: DURING ANGINA

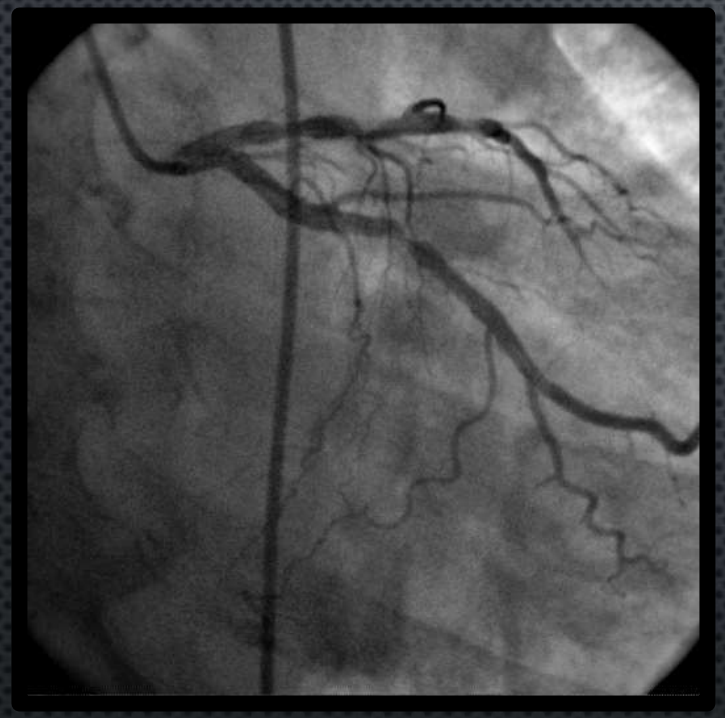
- Increase heart rate
- Increase blood pressure
- S3 and S4 sound
- Maybe Mitral regurgitation murmur

# Clinical manifestations: basic

- Chest discomfort on exertion / stress: predicable
- NTG relief
- Relief by rest

# By the guidelines

# STABLE ISCHEMIC HEART DISEASE (SIHD)




**Robert Chilton DO, FACOI, FACC, FAHA**
**Professor of Medicine**
**University of Texas Health Science Center**
**San Antonio, Texas**
**Director of Cath Lab**
**Director clinical proteomics center**


sihd appropate 2017.pdf

**ACC/AATS/AHA/ASE/ASNC/SCAI/SCCT/ STS 2017 Appropriate Use Criteria for Coronary Revascularization in Patients With Stable Ischemic Heart Disease**

A Report of the American College of Cardiology Appropriate Use Criteria Task Force, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, and Society of Thoracic Surgeons

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sihd 2016.pdf

2019 review

# OBJECTIVES: 9 IMPORTANT THINGS TO KNOWN SIHD

1. Patient presents with history of negative stress test but clinical suspicion of CAD: cath II B
2. Patient has intermediate risk unable to do non invasive testing cath II B

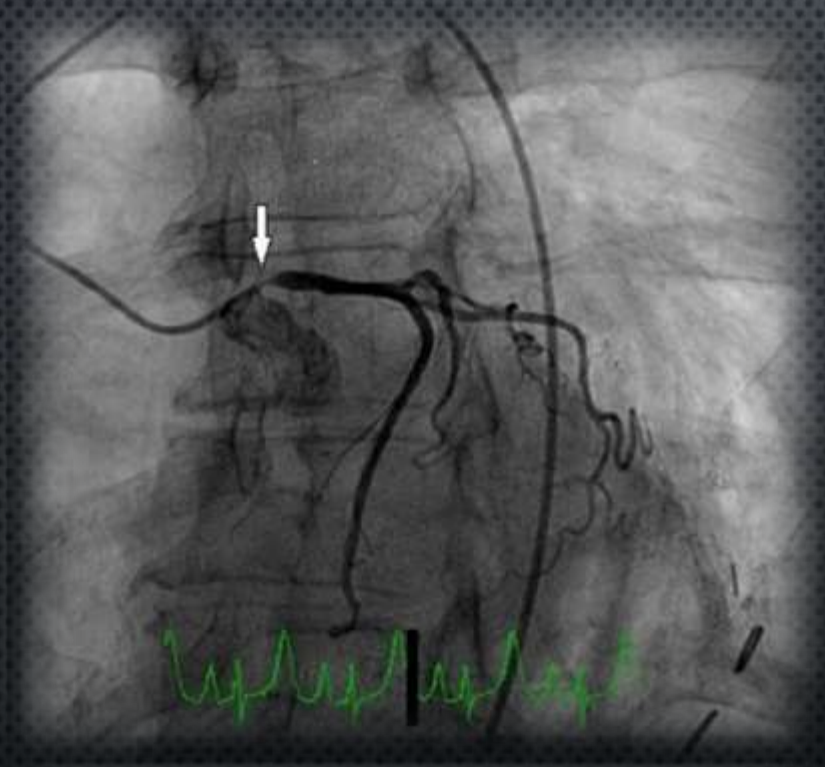
3. FFR from FAME I and II is superior to angiographic visual assessment
4. **IV infusion of EDTA now is Class II B (recent trial found to reduce CV events)**

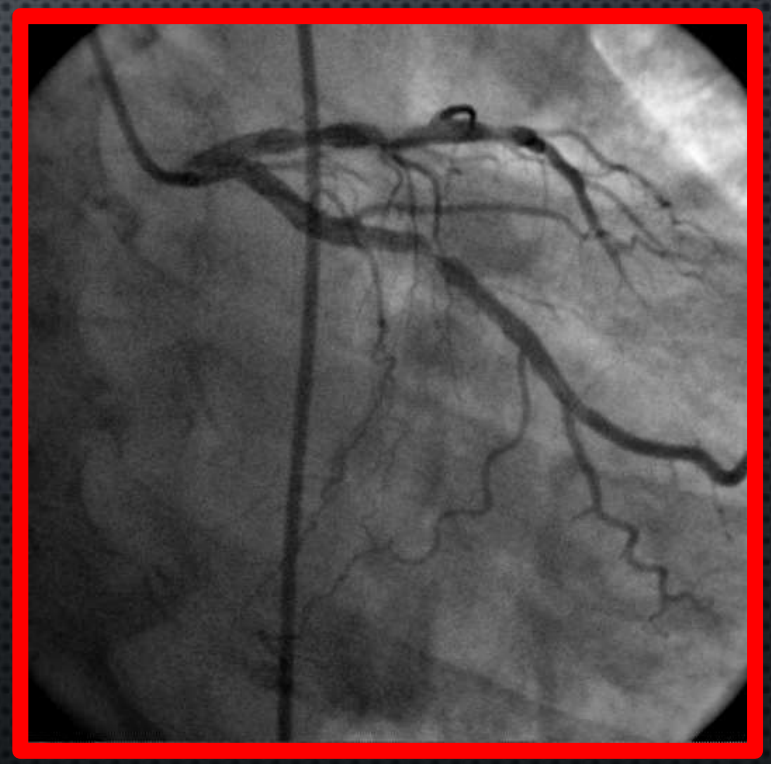
5. Enhanced external counter pulsation (EECP) for relief of refractory angina II B
    - Contraindicated in decompensated HF, PAD or severe aortic regurgitation
6. Heart team approach for revascularization in diabetes / complex patients

7. Left mains heart team pci/CABG
8. CABG with LIMA if DM / complex mv dx first class 1 survival benefit not pci
    - FREEDOM trial in DM primary EP in all sections better
        - Death, non fatal MI/stroke $p<0.005$
        - 5 year rates
            - PCI-26.6%
            - CABG-18.7% Primary endpoint events

**Revascularization** to **Improve *Survival*** Compared With Medical Therapy

| Anatomic Setting | COR | LOE |
|---|---|---|
| **UPLM or complex CAD** | | |
| **CABG and PCI** | I—Heart Team approach recommended | C |
| **CABG and PCI** | IIa—Calculation of STS and SYNTAX scores | B |





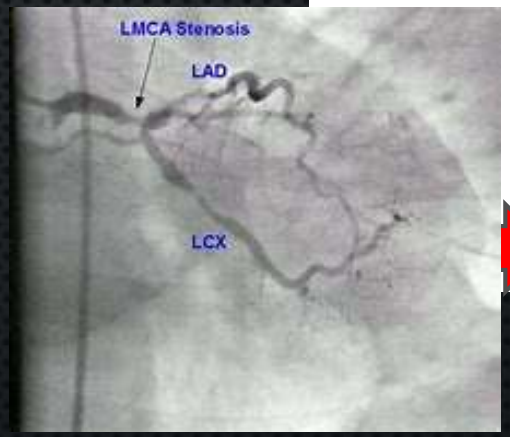
Unprotected left main=UPLM

**Appropriate Use Criteria 2017**

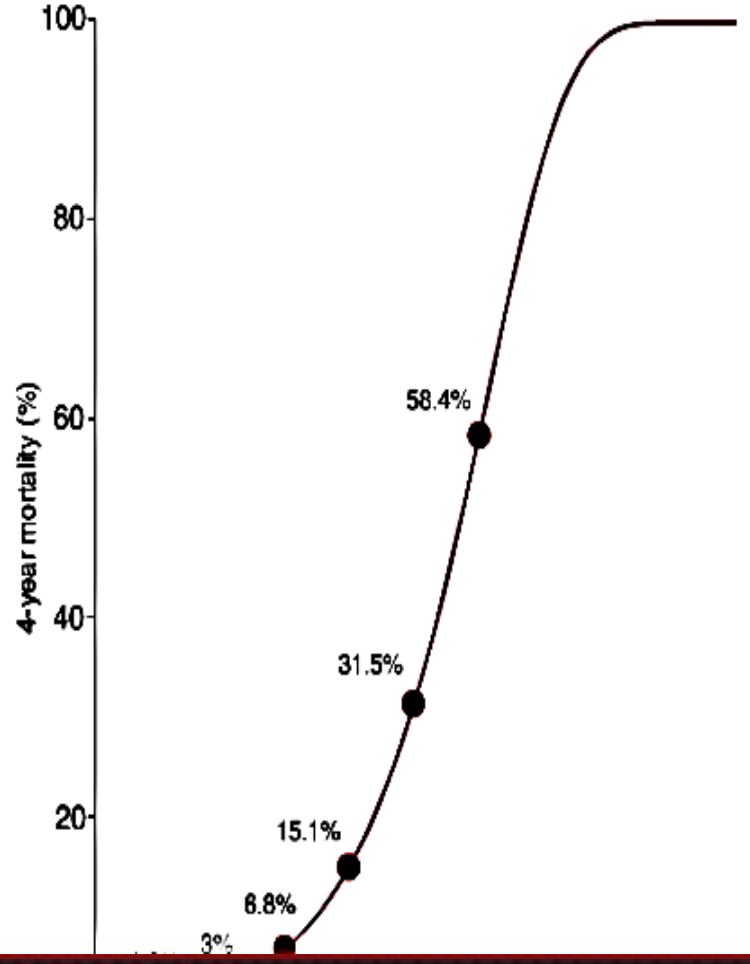
## **Revascularization** to **Improve Survival** Compared With Medical Therapy

Unprotected left main=UPLM

| Anatomic Setting | COR | LOE |
|---|---|---|
| **UPLM*** | | |
| **CABG** | I | B |
| **PCI** | IIa—For SIHD when *both* of the following are present:<br>■ Anatomic conditions associated with a low risk of PCI procedural complications and a high likelihood of good long-term outcome (e.g., a low SYNTAX score of ≤22, ostial or trunk left main CAD)<br>■ Clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (e.g., STS-predicted risk of operative mortality ≥5%) | B |
| | IIa—For UA/NSTEMI if not a CABG candidate | B |
| | IIa—For STEMI when distal coronary flow is TIMI flow grade <3 and PCI can be performed more rapidly and safely than CABG | C |
| | IIb—For SIHD when *both* of the following are present:<br>■ Anatomic conditions associated with a low to intermediate risk of PCI procedural complications and an intermediate to high likelihood of good long-term outcome (e.g., low-intermediate SYNTAX score of <33, bifurcation left main CAD)<br>■ Clinical characteristics that predict an increased risk of adverse surgical outcomes (e.g., moderate—severe COPD, disability from prior stroke, or prior cardiac surgery; STS-predicted operative mortality >2%) | B |
| | III: Harm—For SIHD in patients (versus performing CABG) with unfavorable anatomy for PCI and who are good candidates for CABG | B |



## SYNTAX SCORE II 4-year mortality




Age (years) ⓘ

CrCl ⓘ mL/min

LVEF (%) ⓘ

Left Main ⓘ ○ no ○ yes

Gender ○ male ○ female

COPD ⓘ ○ no ○ yes

PVD ⓘ ○ no ○ yes

SYNTAX Score II Calculate

# PATIENT PRESENTS WITH STRONG ANGINA HISTORY WITHOUT DIABETES AND ANGIOGRAM FINDING SIGNIFICANT COMPLEX 3 VESSEL DISEASE AND SYNTAX SCORE >22

1. Patient has class 1 indication for CABG
2. Patient has equal indication for PCI or CABG without LM or proximal LAD
3. Patient should have global risk reduction and managed medically
4. Patient has a class II A indication for PCI
5. Patient has class II B for CABG

# ANATOMIC SETTING

| Anatomic Setting | COR | LOE |
|---|---|---|
| **3-vessel disease with or without proximal LAD artery disease*** | | |
| **CABG** | I | B |
| | IIa—It is reasonable to choose CABG over PCI in patients with complex 3-vessel CAD (e.g., SYNTAX score >22) who are good candidates for CABG. | B |
| **PCI** | IIb—Of uncertain benefit | B |
| **2-vessel disease with proximal LAD artery disease*** | | |
| **CABG** | I | B |
| **PCI** | IIb—Of uncertain benefit | B |
| **2-vessel disease without proximal LAD artery disease*** | | |
| **CABG** | IIa—With extensive ischemia | B |
| | IIb—Of uncertain benefit without extensive ischemia | C |
| **PCI** | IIb—Of uncertain benefit | B |

# MRS SMITH PRESENTS WITH SYMPTOMATIC CAD AND IS FOUND TO HAVE LAD DISEASE

1. Patient has class 1 indication for CABG
2. Patient has equal indication for PCI or CABG without LM or proximal LAD both class 1
3. Patient should have global risk reduction and managed medically
4. Patient has a class II A indication for PCI
5. Patient has class II A for CABG

No class 1 for LAD disease

| | | |
|---|---|---|
| **1-vessel proximal LAD artery disease** | | |
| **CABG** | IIa—With LIMA for long-term benefit | B |
| **PCI** | IIb—Of uncertain benefit | B |
| **1-vessel disease without proximal LAD artery involvement** | | |
| **CABG** | III: Harm | B |
| **PCI** | III: Harm | B |
| **LV dysfunction** | | |
| **CABG** | IIa—EF 35% to 50% | B |
| **CABG** | IIb—EF <35% without significant left main CAD | B |
| **PCI** | Insufficient data | |
| **Survivors of sudden cardiac death with presumed ischemia-mediated VT** | | |
| **CABG** | I | B |
| **PCI** | I | C |

# To IMPROVE SURVIVAL

# MR JONES PRESENTS TO CCU WITH EF < 15% AND **>10% MYOCARDIAL SEGMENTAL SCORE** BY ECHO WHAT IS HIS **ANNUAL DEATH / MI PERCENTAGE**

1. 0.5%
2. 1%
3. 2%
4. >3% or more annually

**TABLE B** **Noninvasive Risk Stratification**

High risk (>3% annual death or MI)

1. Severe resting LV dysfunction (LVEF <35%) not readily explained by noncoronary causes
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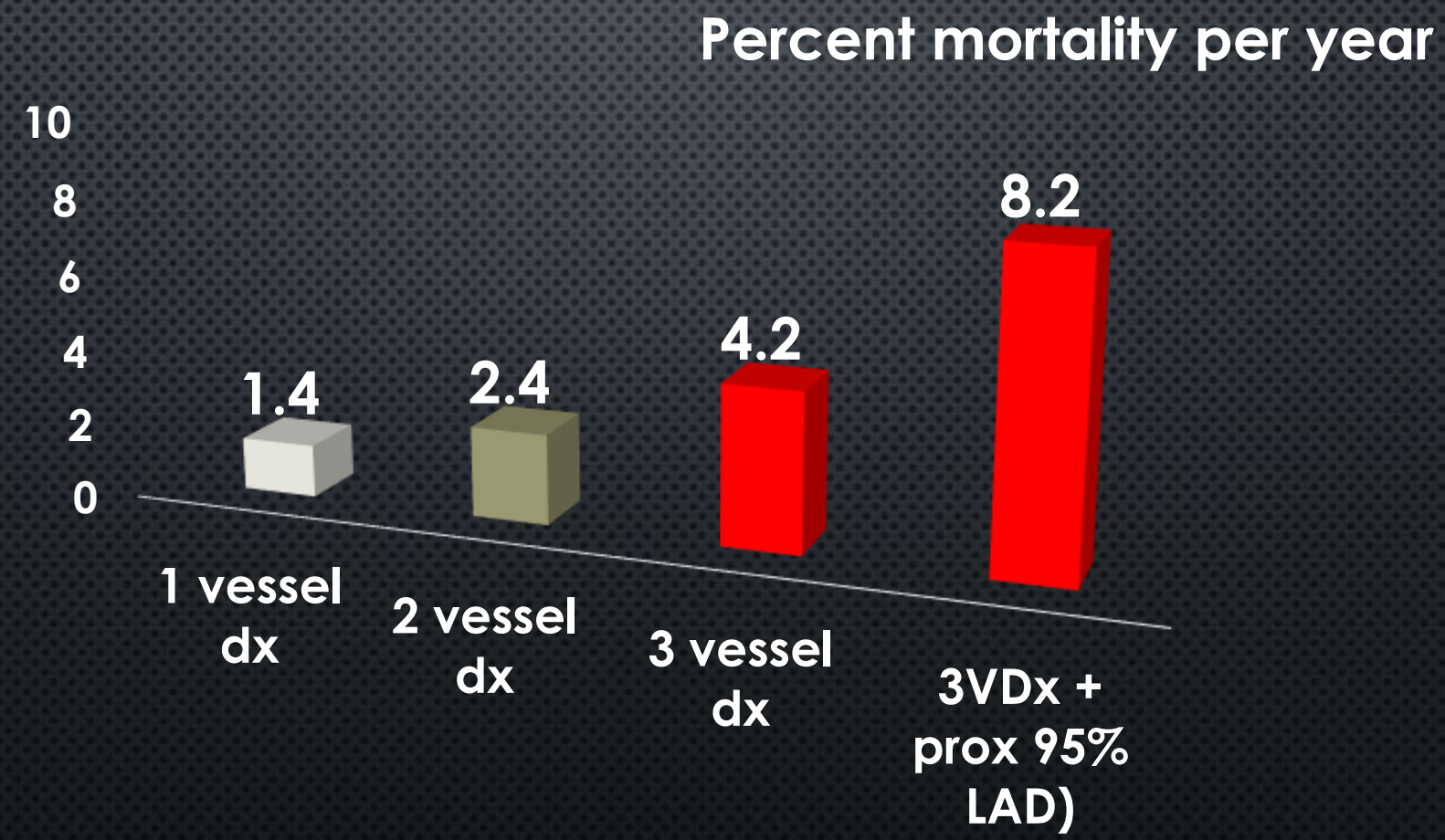
8. Wall motion abnormality developing at low dose of dobutamine (≤10 mg/kg/min) or at a low heart rate (<120 beats/min)
9. CAC score >400 Agatston units
10. Multivessel obstructive CAD (≥70% stenosis) or left main stenosis (≥50% stenosis) on CCTA

# YEARLY MORTALITY (DEATH) IN MEDICALLY TREATED PATIENTS BY CORONARY ANGIOGRAM




J Am Coll Cardiol. 1996;27:964–1047

Adapted from al Patel et al

Landmark Trials

The NEW ENGLAND JOURNAL of MEDICINE

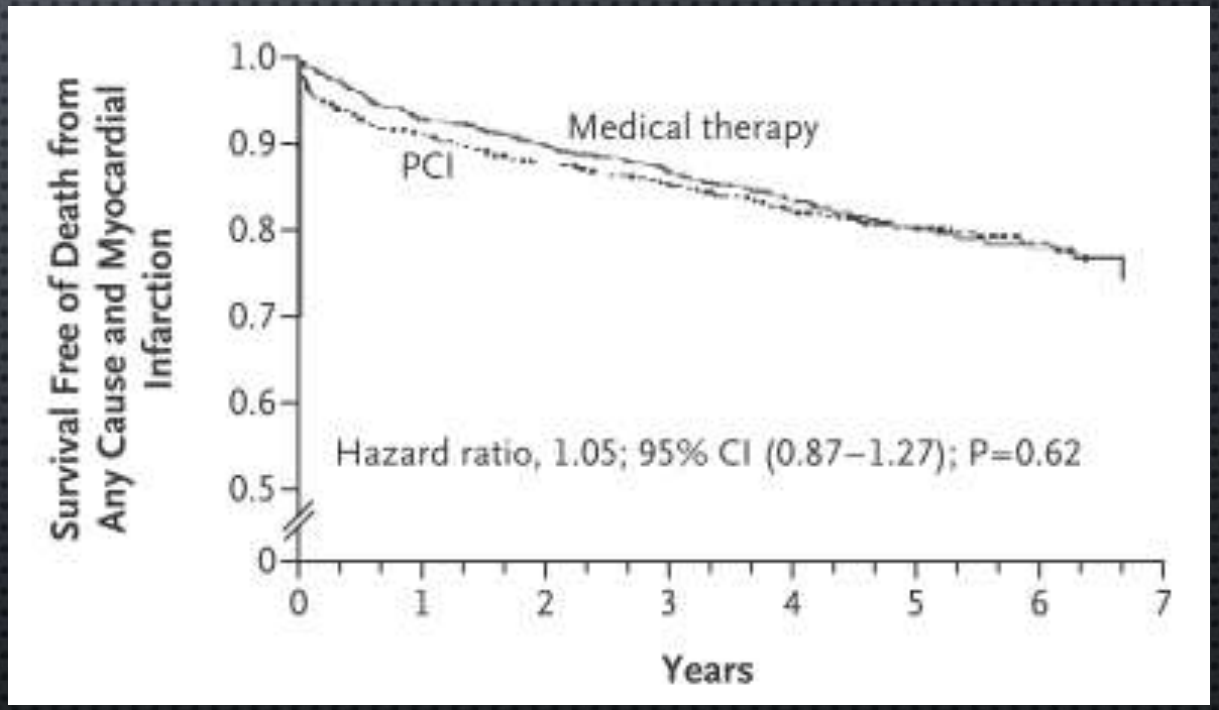
ESTABLISHED IN 1812 APRIL 12, 2007 VOL. 356 NO. 15

# Optimal Medical Therapy with or without PCI for Stable Coronary Disease

William E. Boden, M.D., Robert A. O'Rourke, M.D., Koon K. Teo, M.B., B.Ch., Ph.D., Pamela M. Hartigan, Ph.D., David J. Maron, M.D., William J. Kostuk, M.D., Merril Knudtson, M.D., Marcin Dada, M.D., Paul Casperson, Ph.D., Crystal L. Harris, Pharm.D., Bernard R. Chaitman, M.D., Leslee Shaw, Ph.D., Gilbert Gosselin, M.D., Shah Nawaz, M.D., Lawrence M. Title, M.D., Gerald Gau, M.D., Alvin S. Blaustein, M.D., David C. Booth, M.D., Eric R. Bates, M.D., John A. Spertus, M.D., M.P.H., Daniel S. Berman, M.D., G.B. John Mancini, M.D., and William S. Weintraub, M.D., for the COURAGE Trial Research Group*

courage trial org.pdf

Randomized trial involving 2287 patients who had objective evidence of myocardial ischemia and significant coronary artery disease



The NEW ENGLAND JOURNAL of MEDICINE

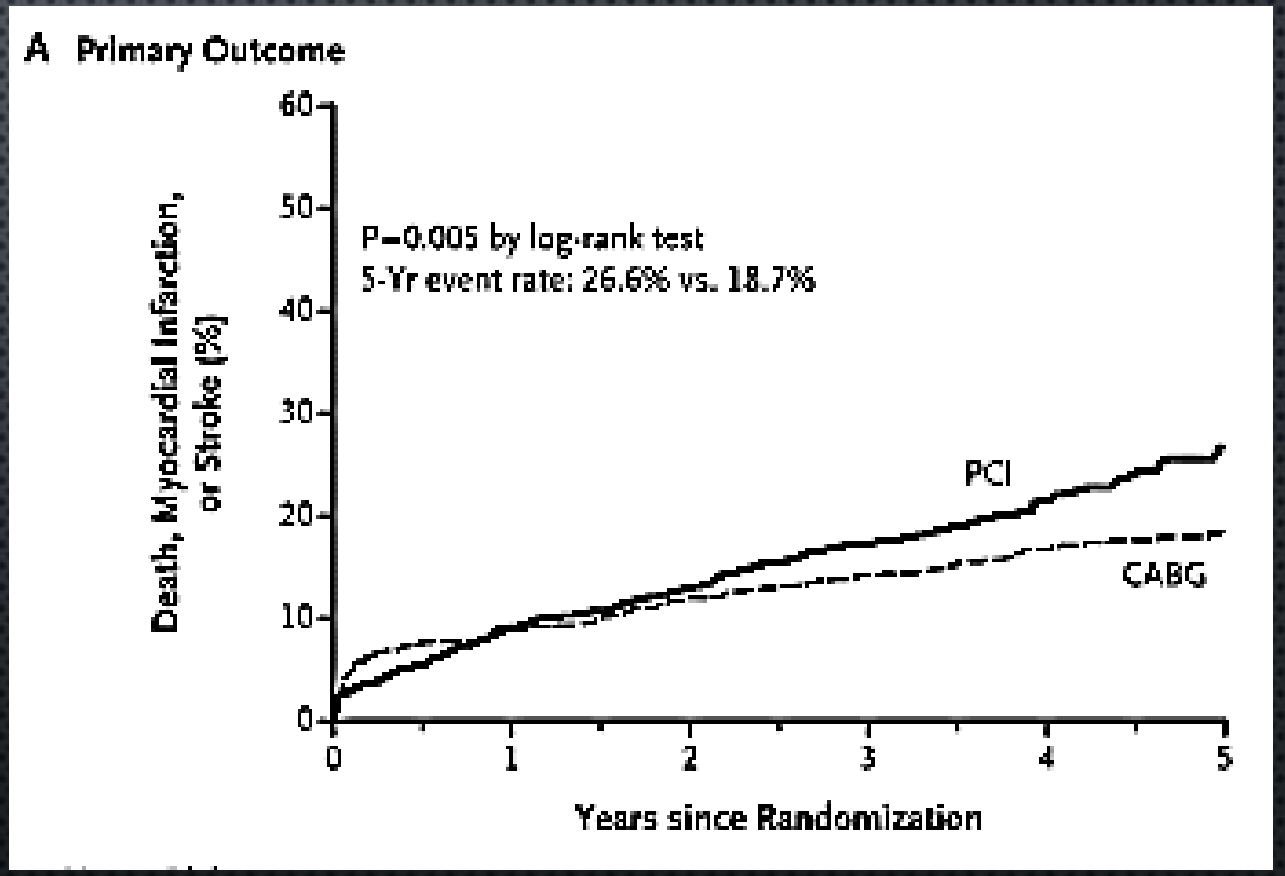
ESTABLISHED IN 1812 DECEMBER 20, 2012 VOL. 367 NO. 25

# Strategies for Multivessel Revascularization in Patients with Diabetes

Michael E. Farkouh, M.D., Michael Domanski, M.D., Lynn A. Sleeper, Sc.D., Flora S. Siami, M.P.H., George Dangas, M.D., Ph.D., Michael Mack, M.D., May Yang, M.P.H., David J. Cohen, M.D., Yves Rosenberg, M.D., M.P.H., Scott D. Solomon, M.D., Akshay S. Desai, M.D., M.P.H., Bernard J. Gersh, M.B., Ch.B., D.Phil., Elizabeth A. Magnuson, Sc.D., Alexandra Lansky, M.D., Robin Boineau, M.D., Jesse Weinberger, M.D., Krishnan Ramanathan, M.B., Ch.B., J. Eduardo Sousa, M.D., Ph.D., Jamie Rankin, M.D., Balram Bhargava, M.D., John Buse, M.D., Whady Hueb, M.D., Ph.D., Craig R. Smith, M.D., Victoria Muratov, M.D., M.P.H., Sameer Bansilal, M.D., Spencer King III, M.D., Michel Bertrand, M.D., and Valentin Fuster, M.D., Ph.D., for the FREEDOM Trial Investigators*

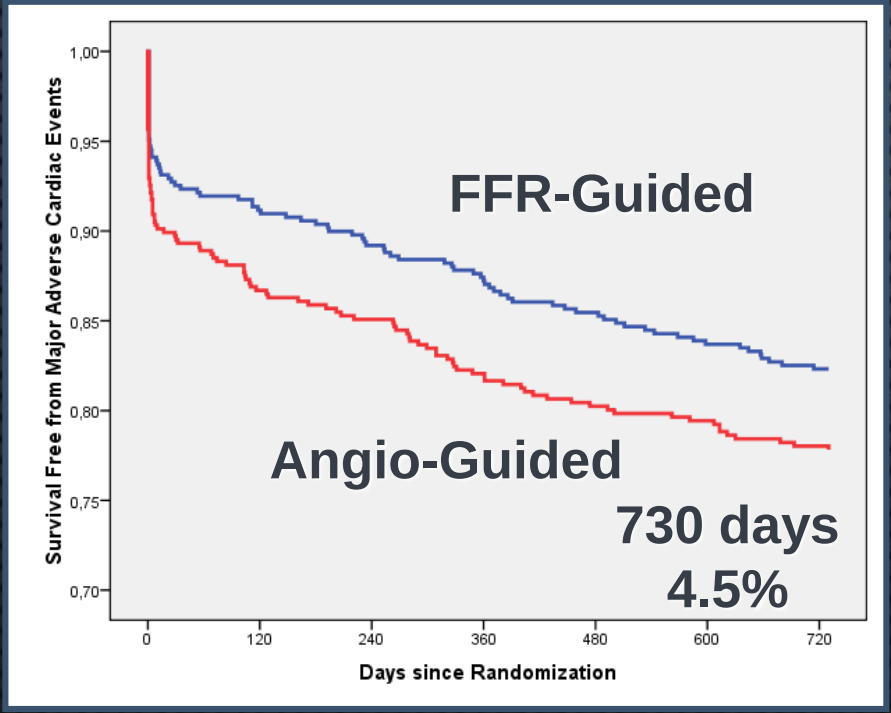
Primary outcome measure was a composite of death from any cause, nonfatal myocardial infarction, or nonfatal stroke

## Diabetes and multivessel coronary artery disease to undergo either PCI with drug-eluting stents or CABG



# FFR VS. ANGIOGRAPHY FOR MULTIVESSEL EVALUATION

## FAME
## *2 YEAR FOLLOW-UP*




***PCI performed on indicated lesions only if FFR ≤0.80***

PCI performed on indicated lesions

Randomized

Primary Endpoint

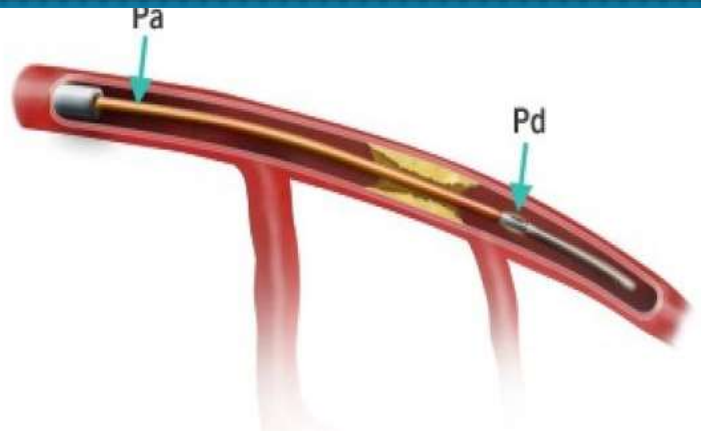
Composite of death, MI and repeat revasc. (MACE) at 1 year

Key Secondary Endpoints

Individual rates of death, MI, and repeat revasc., MACE, and functional status at 2 years

$$FFR = \frac{\text{Distal Coronary Pressure (Pd)}}{\text{Proximal Coronary Pressure (Pa)}}$$

(During Maximum Hyperemia)



# 2014 ACC/AHA/AATS/PCNA/SCAI/STS Focused Update of the Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease

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## 2.3. Invasive Testing for Diagnosis of Coronary Artery Disease in Patients With Suspected SIHD: Recommendations (New Section)

*See Online Data Supplement 1 for additional information.*

### Class I

1. Coronary angiography is useful in patients with presumed SIHD who have unacceptable ischemic symptoms despite GDMT and who are amenable to, and candidates for, coronary revascularization. *(Level of Evidence: C)*

### Class IIa

1. Coronary angiography is reasonable to define the extent and severity of coronary artery disease (CAD) in patients with suspected SIHD whose clinical characteristics and results of noninvasive testing *(exclusive of stress testing)* indicate a high likelihood of severe IHD and who are amenable to, and candidates for, coronary revascularization.[7–12] *(Level of Evidence: C)*
2. Coronary angiography is reasonable in patients with suspected symptomatic SIHD who cannot undergo diagnostic stress testing, or have indeterminate or nondiagnostic stress tests, when there is a high likelihood that the findings will result in important changes to therapy. *(Level of Evidence: C)*

No class 3

**Table 4. Recommendations for CAD Revascularization to Improve Survival**

| 2012 Recommendation | 2014 Focused Update Recommendations | Comments |
|---|---|---|
| Class IIa | Class I | |
| 1. CABG is probably recommended in preference to PCI to improve survival in patients with multivessel CAD and diabetes mellitus, particularly if a LIMA graft can be anastomosed to the LAD artery.[58-66] *(Level of Evidence: B)* | 1. A Heart Team approach to revascularization is recommended in patients with diabetes mellitus and complex multivessel CAD.[66] *(Level of Evidence: C)* | New recommendation |
| | 2. CABG is generally recommended in preference to PCI to improve survival in patients with diabetes mellitus and multivessel CAD for which revascularization is likely to improve survival (3-vessel CAD or complex 2-vessel CAD involving the proximal LAD), particularly if a LIMA graft can be anastomosed to the LAD artery, provided the patient is a good candidate for surgery.[58-59] *(Level of Evidence: B)* | Modified recommendation (Class of Recommendation changed from IIa to I, wording modified, additional RCT added). |

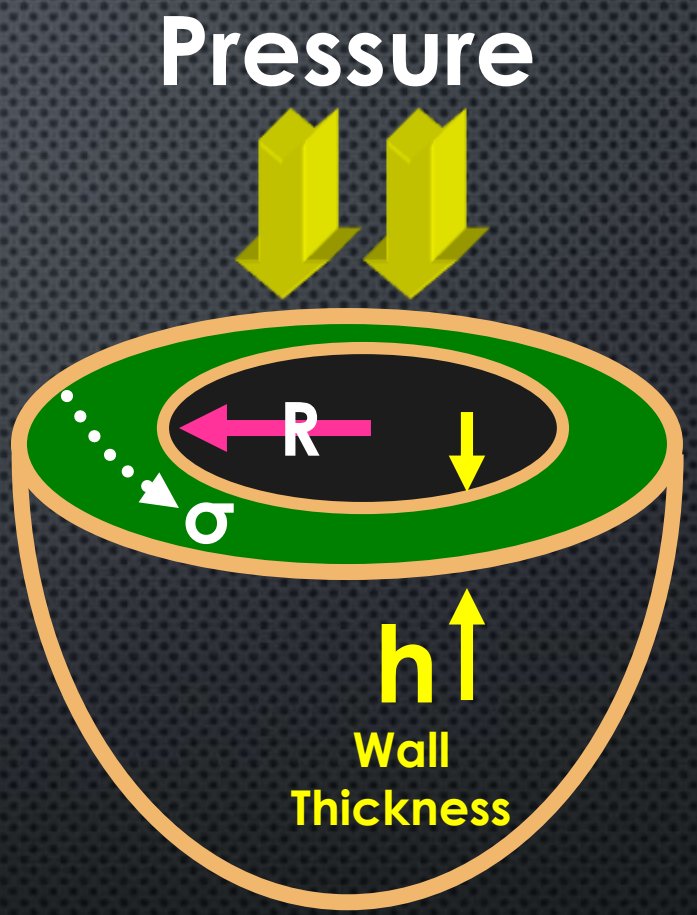
CABG indicates coronary artery bypass graft; CAD, coronary artery disease; LAD, left anterior descending; LIMA, left internal mammary artery; PCI, percutaneous coronary intervention; and RCT, randomized controlled trial.

**No trial has suggested a survival advantage of PCI**
**PCI for symptom relief……..**

Closing slide: translational biology

# Myocardial Oxygen Consumption Factors $MVO_2$

- **Heart Rate**
  - **Most important**
- Myocardial wall tension
  - Pressure
  - Volume
  - Thickness
- Contractility




$\sigma = P \times R/2h$

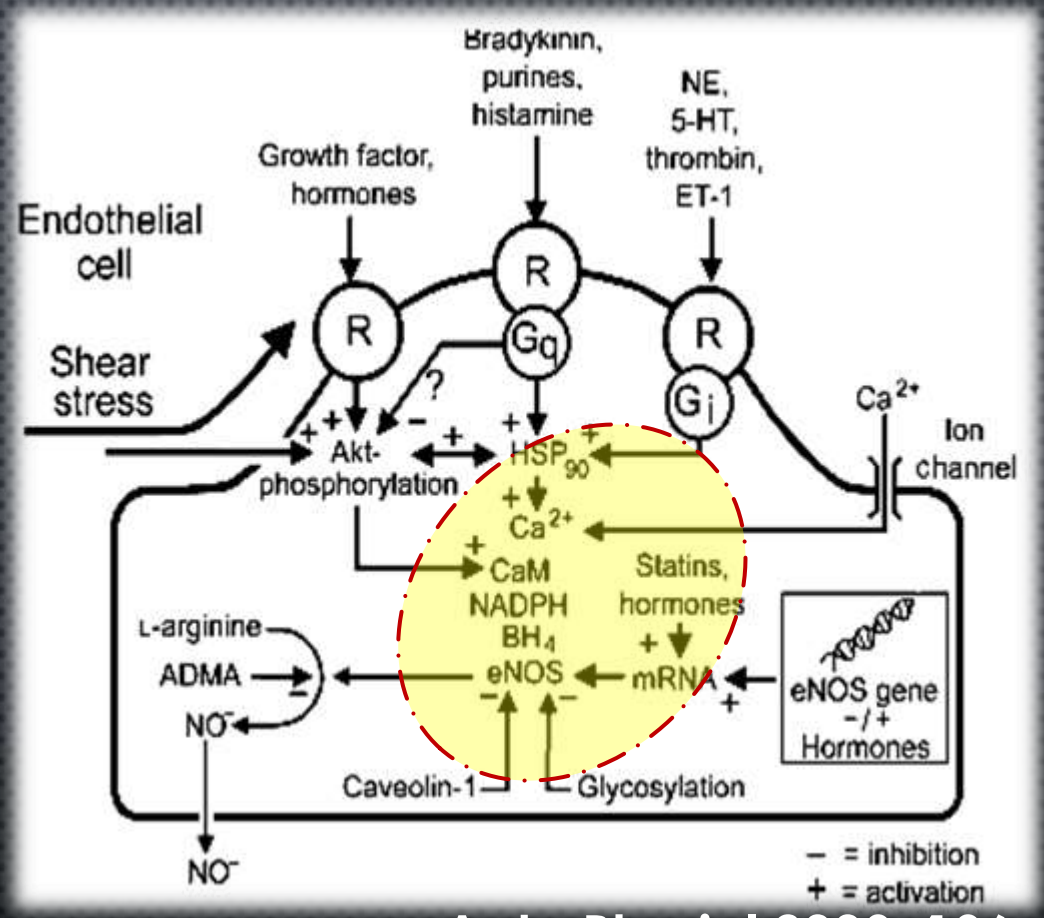
**LaPlace's Law**

σ=Wall Tension
P=Pressure
R=Radius
h=Wall thickness

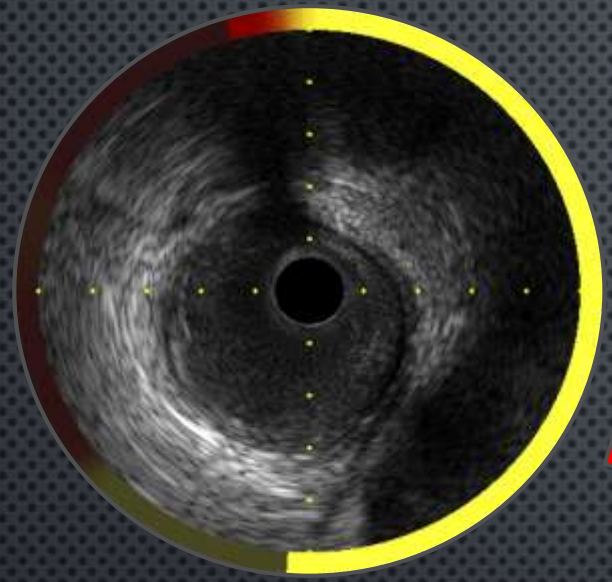
# 4 TAKE HOME MESSAGES

- PICK YOUR PARENTS CAREFULLY
- CONTROL YOU ENVIRONMENT …DRUGS / SURGERY ARE NOT MATCH FOR UNCONTROLLED ENVIRONMENT
- VASCULAR / TISSUE – BLOOD PRESSURE VERY IMPORTANT..WALL STRESS
- METABOLICS – NUTRIENTS OF VASCULAR LIFE…NEEDS CLEAN FUEL FOR HEALTHY ENDOTHELIUM

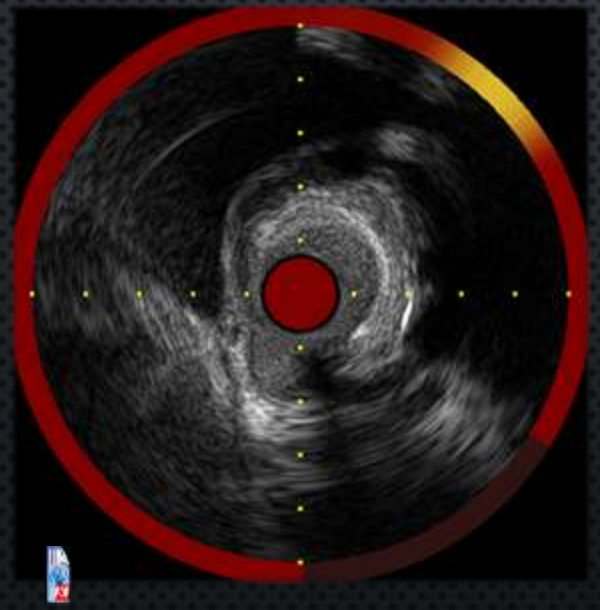
## Nitric oxide is life

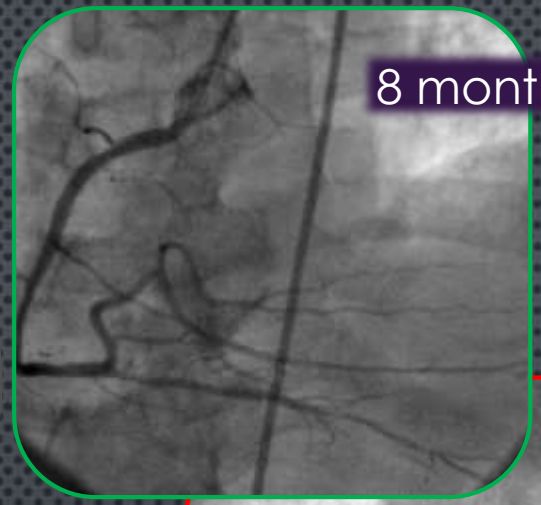



Acta Physiol 2009, 196, 193–222

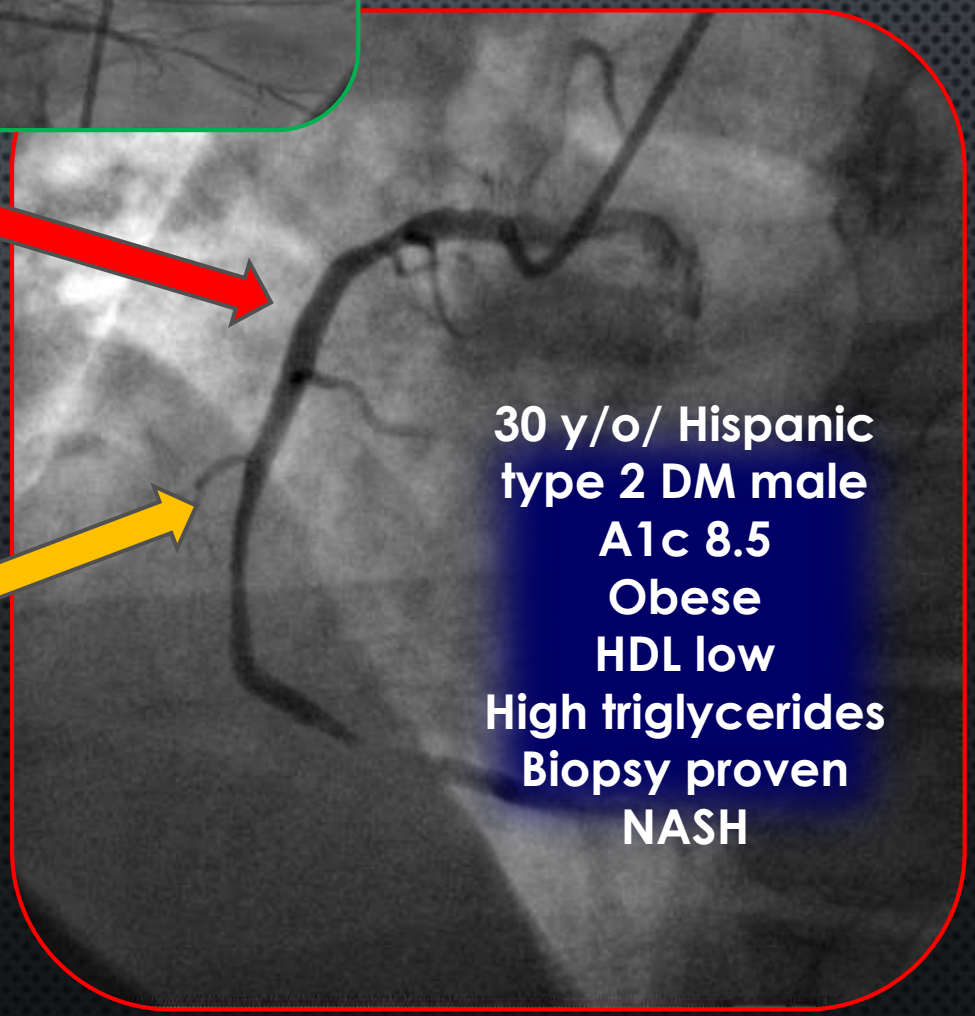


NIRS-IVUS





8 months before



30 y/o/ Hispanic
type 2 DM male
A1c 8.5
Obese
HDL low
High triglycerides
Biopsy proven
NASH

Post test

# PATIENT PRESENTS WITH STRONG ANGINA HISTORY WITHOUT DIABETES AND ANGIOGRAM FINDING SIGNIFICANT COMPLEX 3 VESSEL DISEASE AND SYNTAX SCORE >22

1. **Patient has class 1 indication for CABG**
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3. **Patient should have global risk reduction and managed medically**
4. **Patient has a class II A indication for PCI**
5. **Patient has class II B for CABG**

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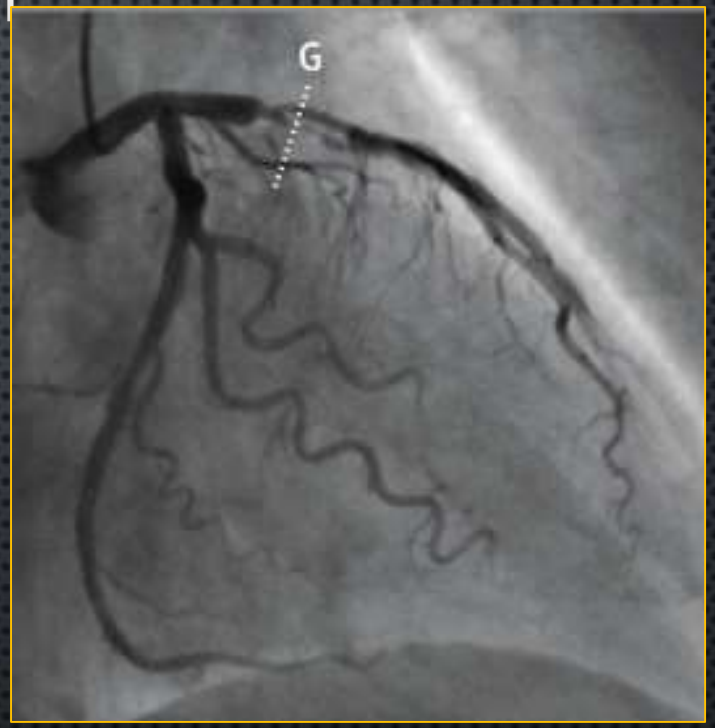

# MR JONES PRESENTS TO CCU WITH EF < 15% AND >10% MYOCARDIAL SEGMENTAL SCORE BY ECHO WHAT IS HIS ANNUAL DEATH / MI PERCENTAGE

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**TABLE B** **Noninvasive Risk Stratification**

High risk (>3% annual death or MI)

1. Severe resting LV dysfunction (LVEF <35%) not readily explained by noncoronary causes
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9. CAC score >400 Agatston units
10. Multivessel obstructive CAD (≥70% stenosis) or left main stenosis (≥50% stenosis) on CCTA

Thank you