

# Optimal Candidate for PCI: In Patients with ICMP

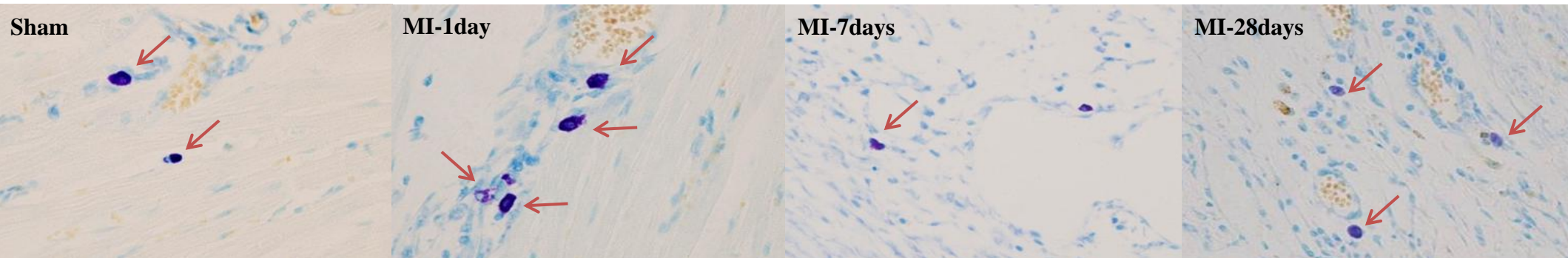
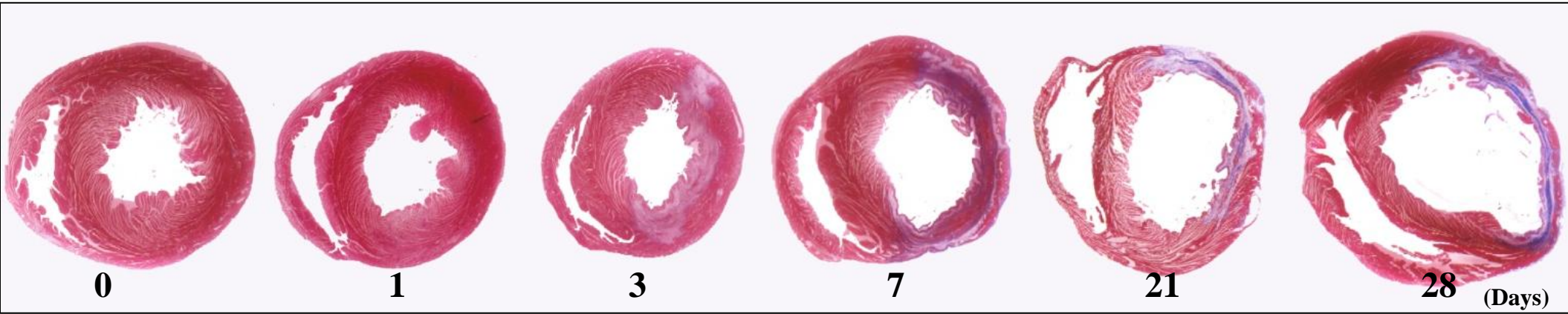
전남의대  
순환기내과

안영근



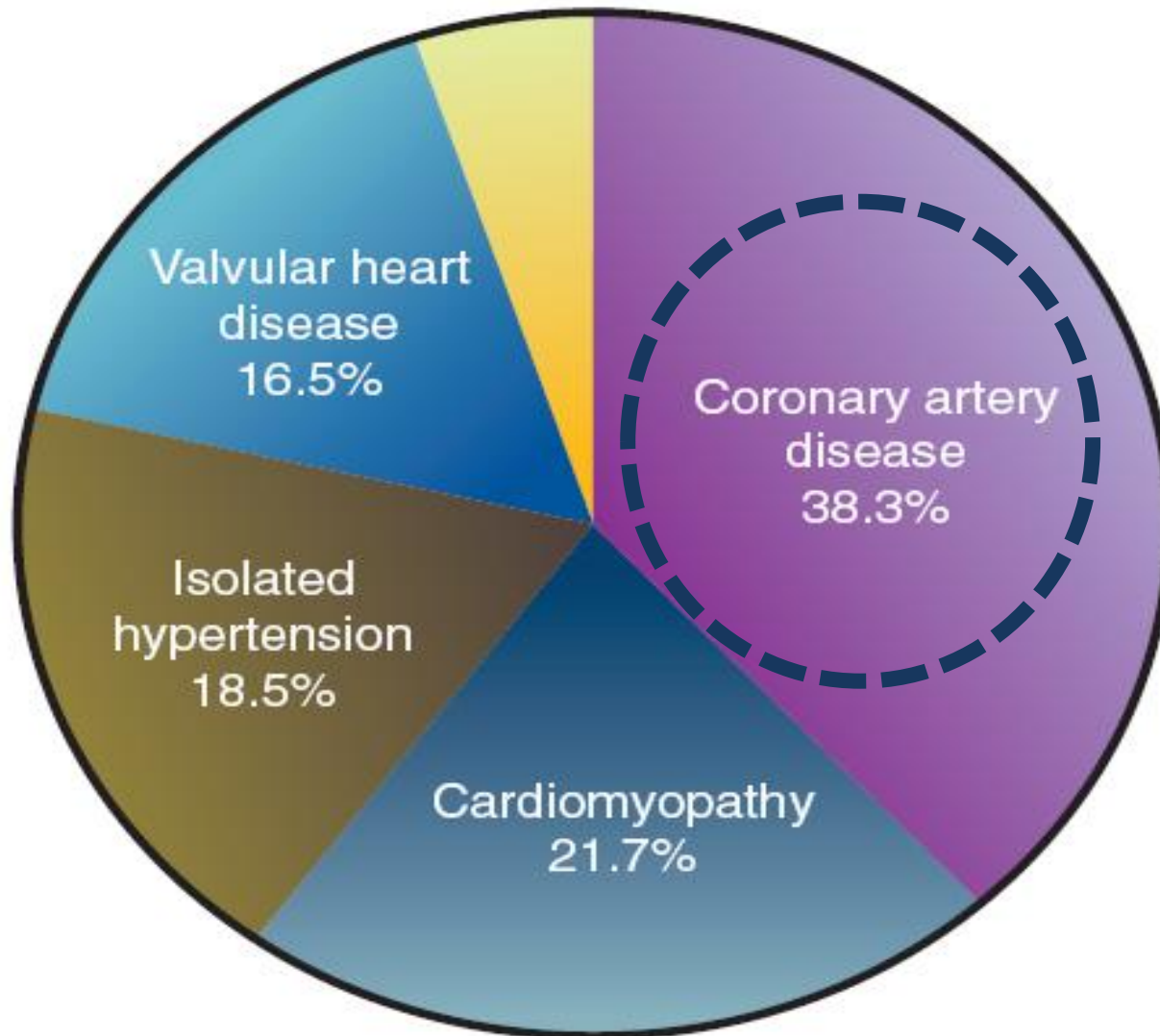
# Progression of MI in a Rat Model

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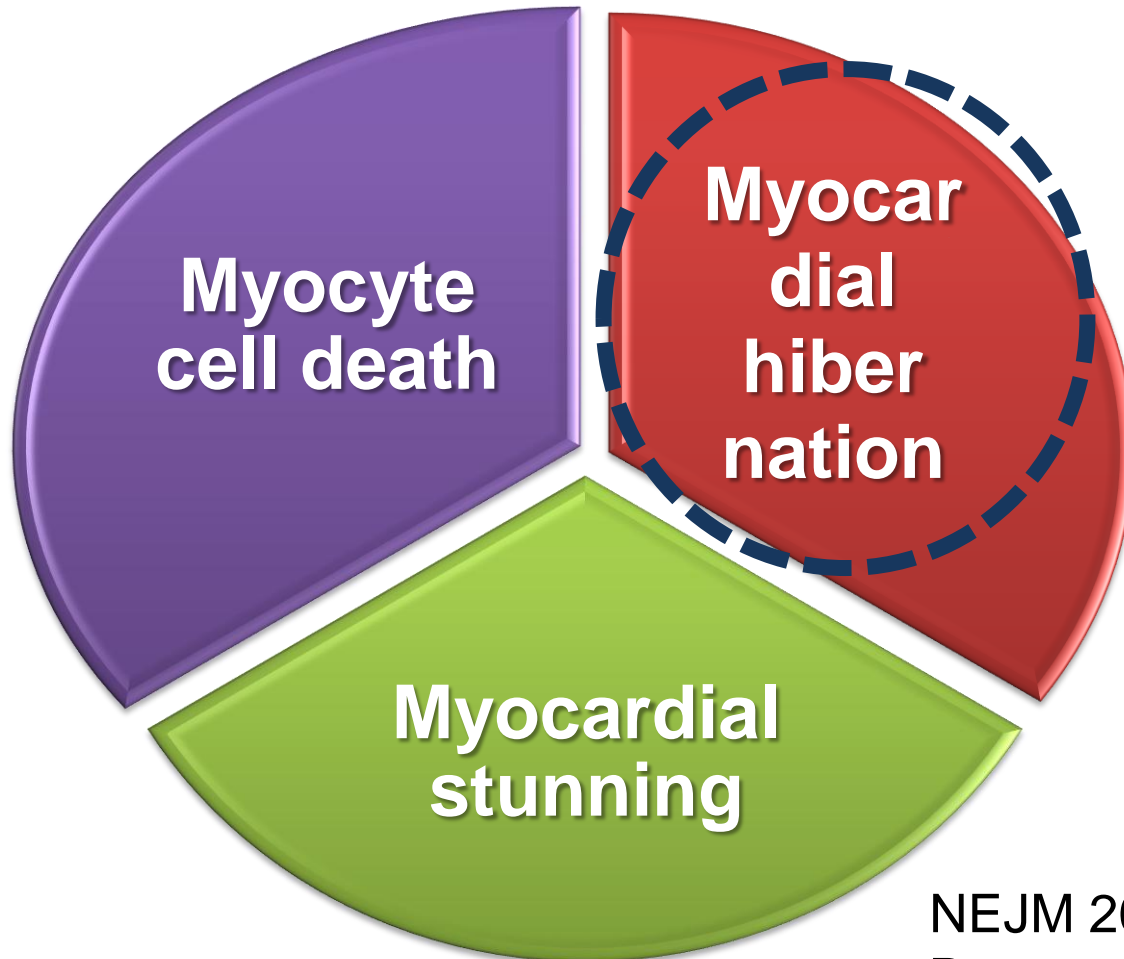
# 1<sup>st</sup> Cause of HF

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# Definition

HF who have had a MI or have evidence of hibernating myocardium or, on angiography, severe coronary disease



NEJM 2010;362:228

Braunwald's Heart Disease 9th Edition

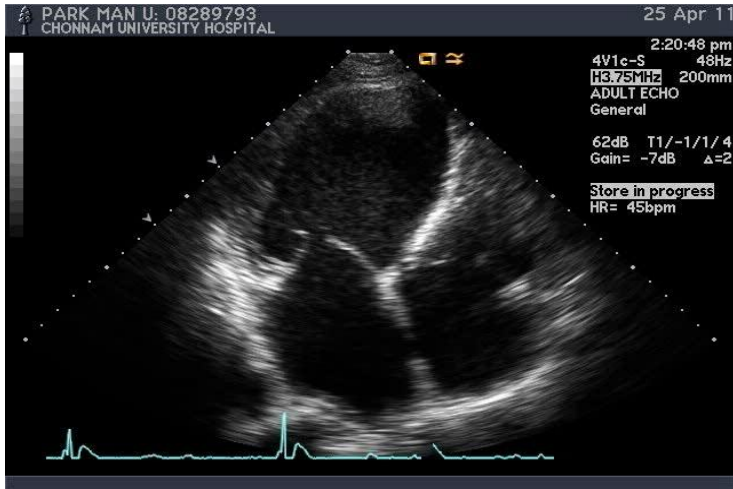


# ICMP contains akinetic myocardium !

Akinetic myocardium

≠

Non-viable myocardium



# Question

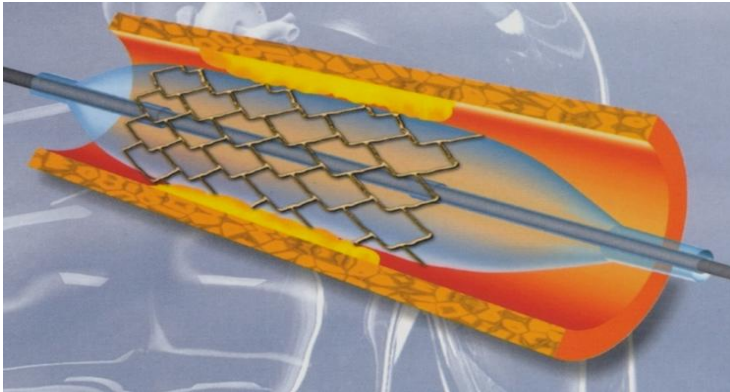
1. Can akinetic myocardium in ICMP patients be salvaged?



**Yes!**

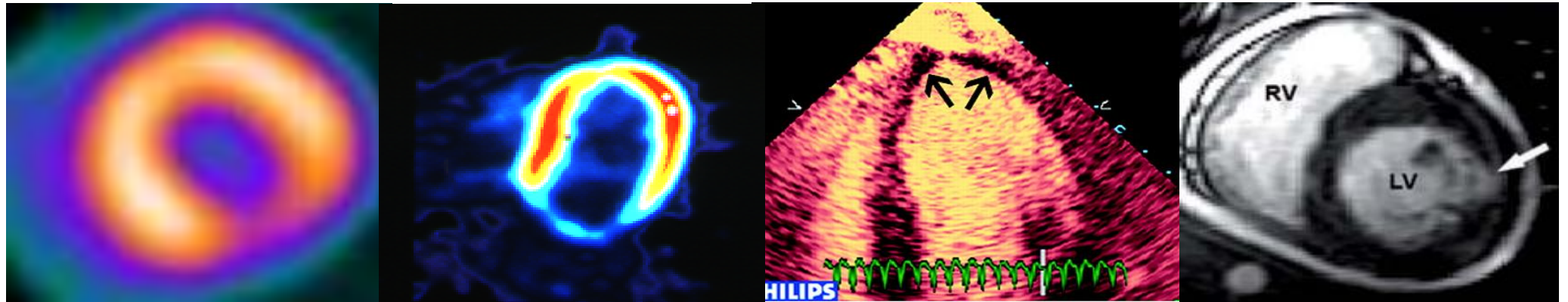
# Question

## 2. How can akinetic myocardium be salvaged in ICMP patients?



# Question

3. How can clinicians differentiate viable myocardium from non-viable myocardium?





# Today's Topic

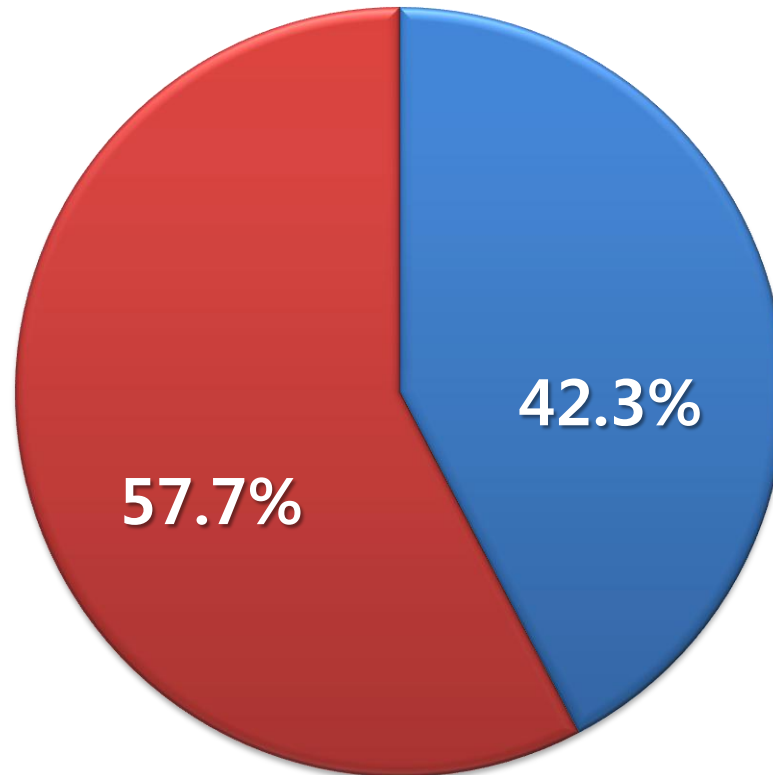
**Who can get benefit from PCI in patients with ICMP?**



# Viability myocardium in ICMP

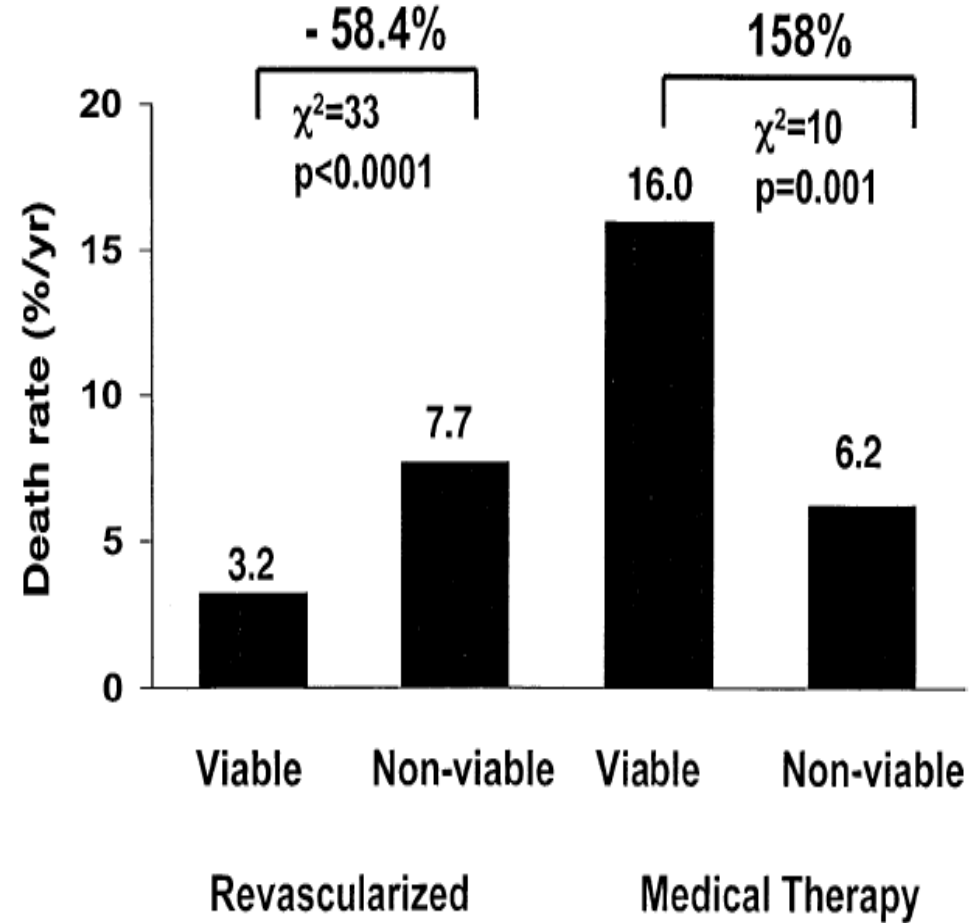
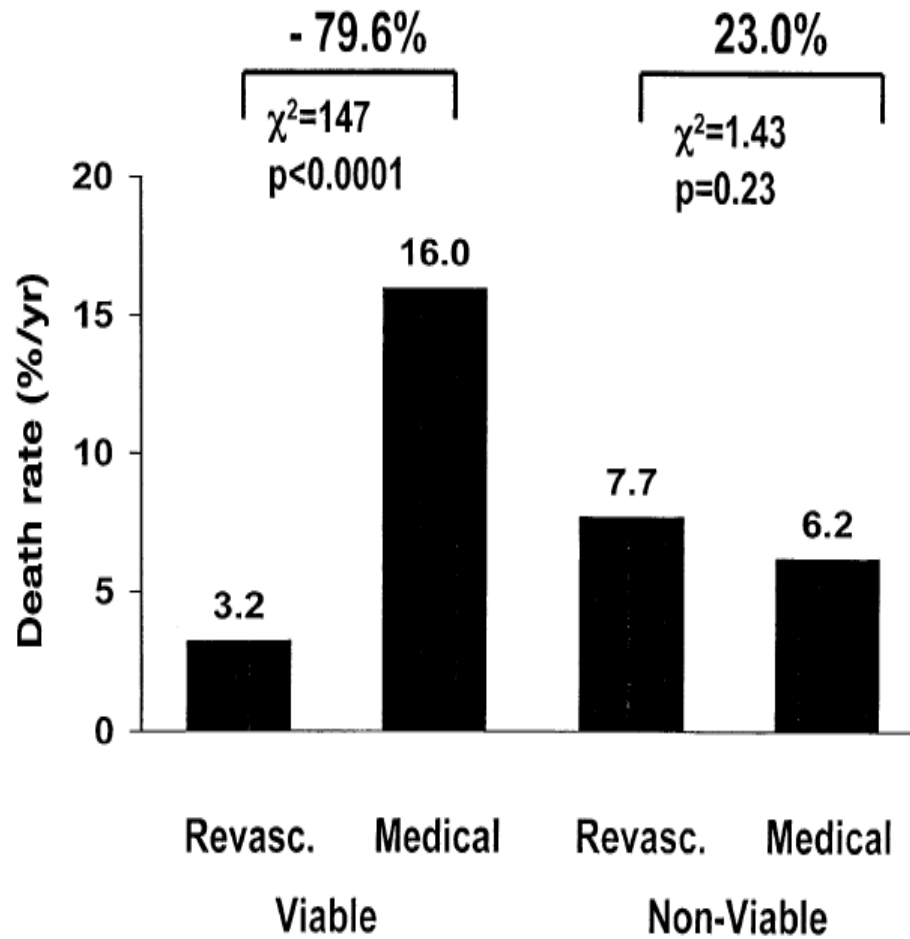
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**Meta-analysis : 3,088 ICMP patients (EF=32.9%) in 24 viability studies (TI-201, Dobutamine echo, F-18 FDG)**



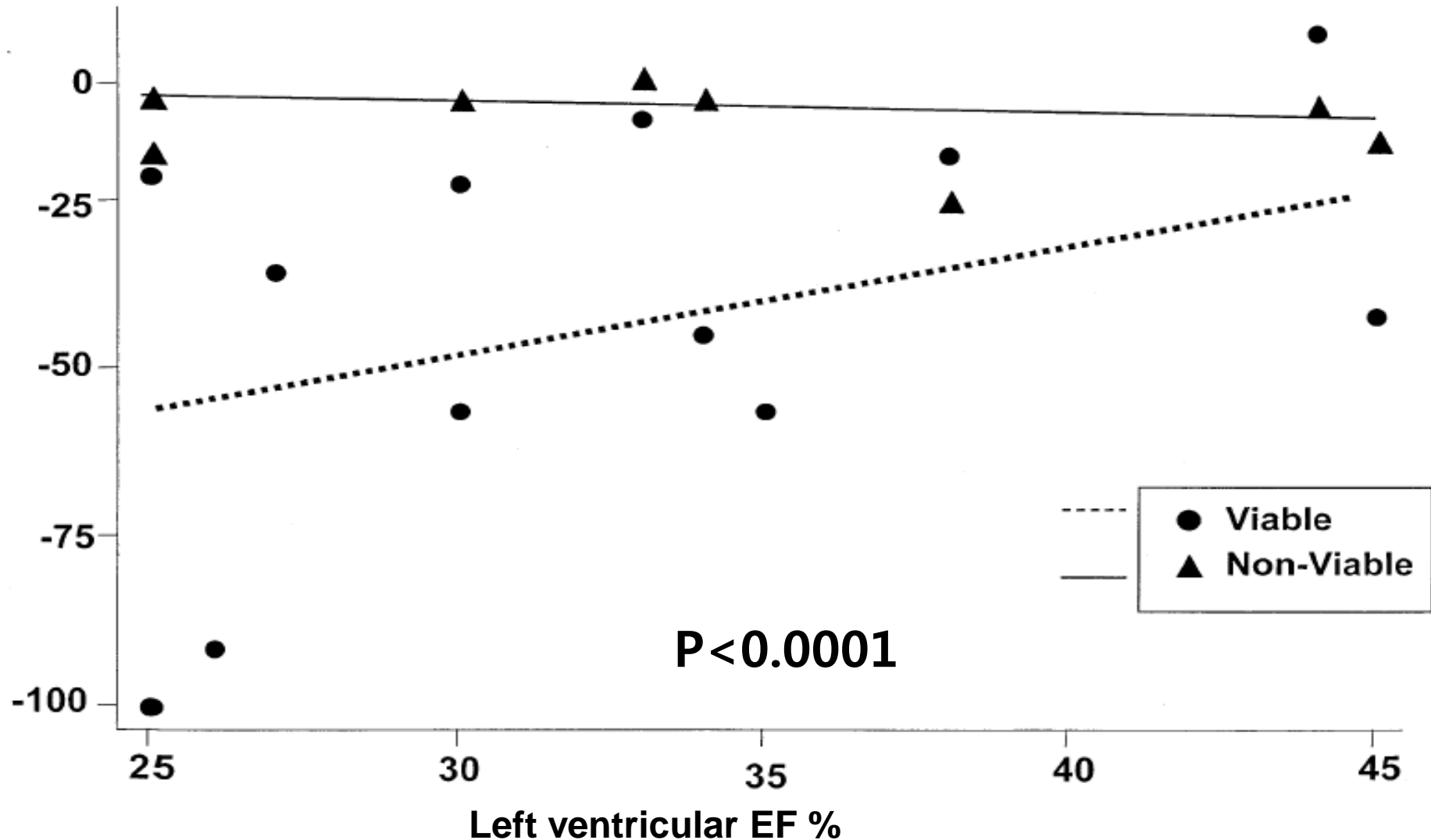
■ viable myocardium ■ non-viable myocardium

# Viability myocardium in ICMP



# Viability myocardium in ICMP

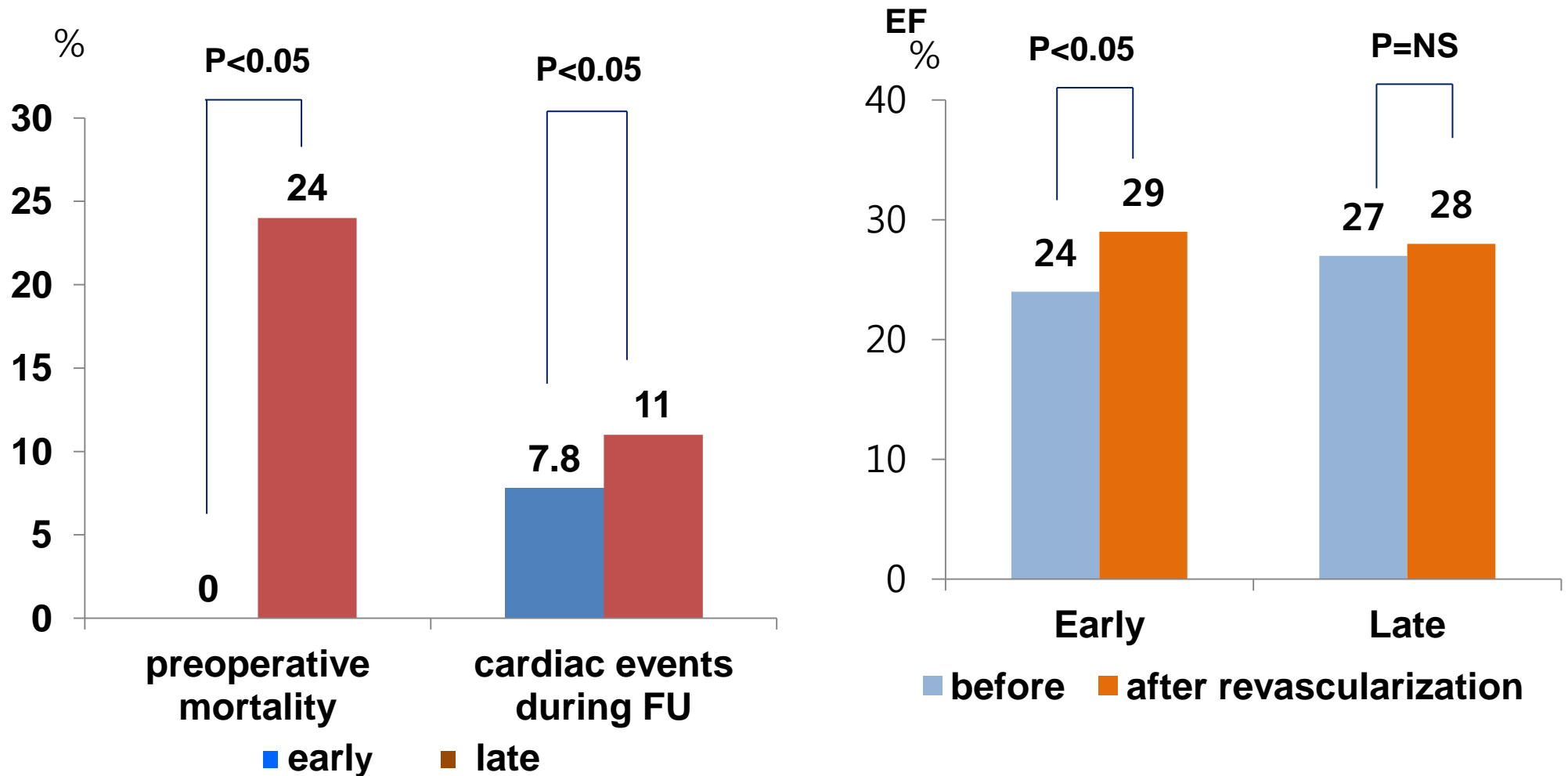
## Predicted reduction in death rate with revascularization





# Viability myocardium in ICMP

Early (< 35 days) vs. Late (> 35 days) revascularization in ICMP (EF < 35%) patients with viable myocardium evaluated by FDG-PET

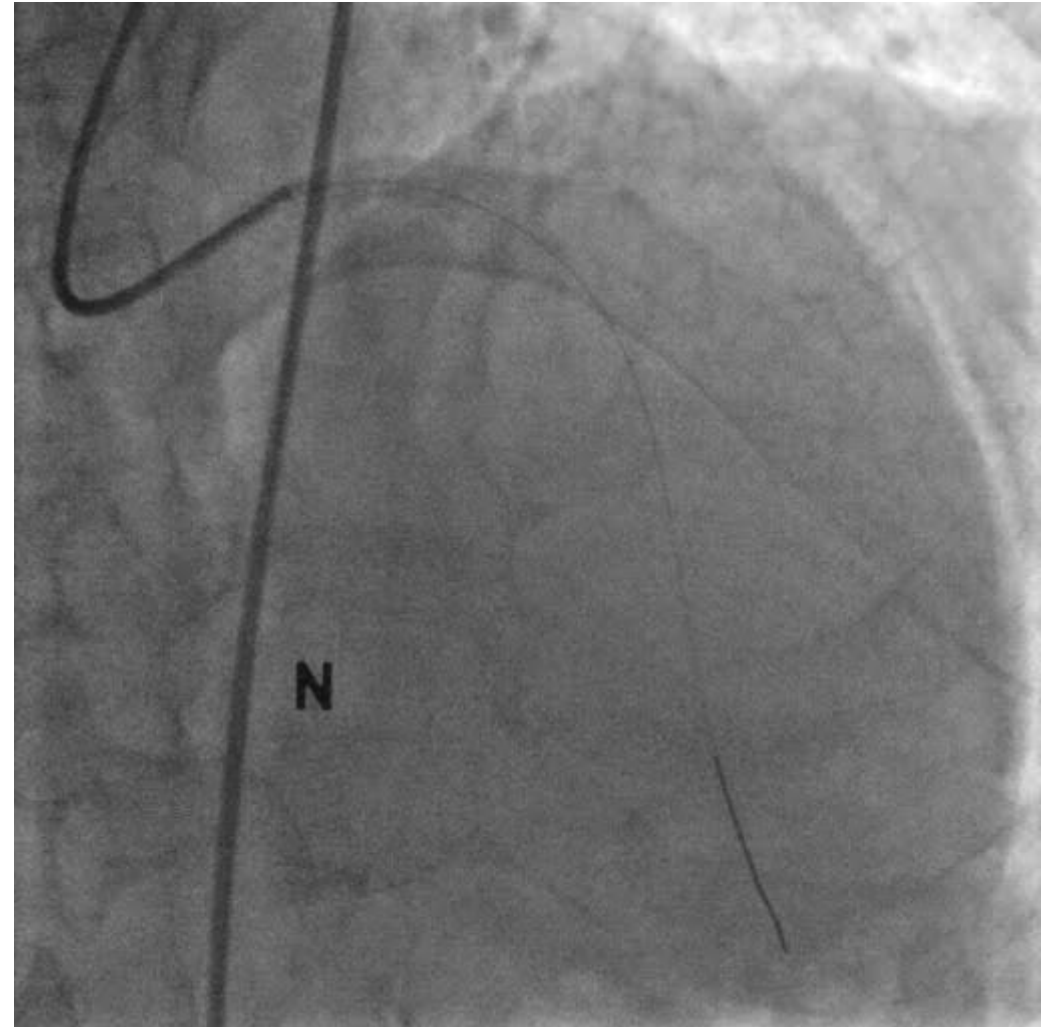
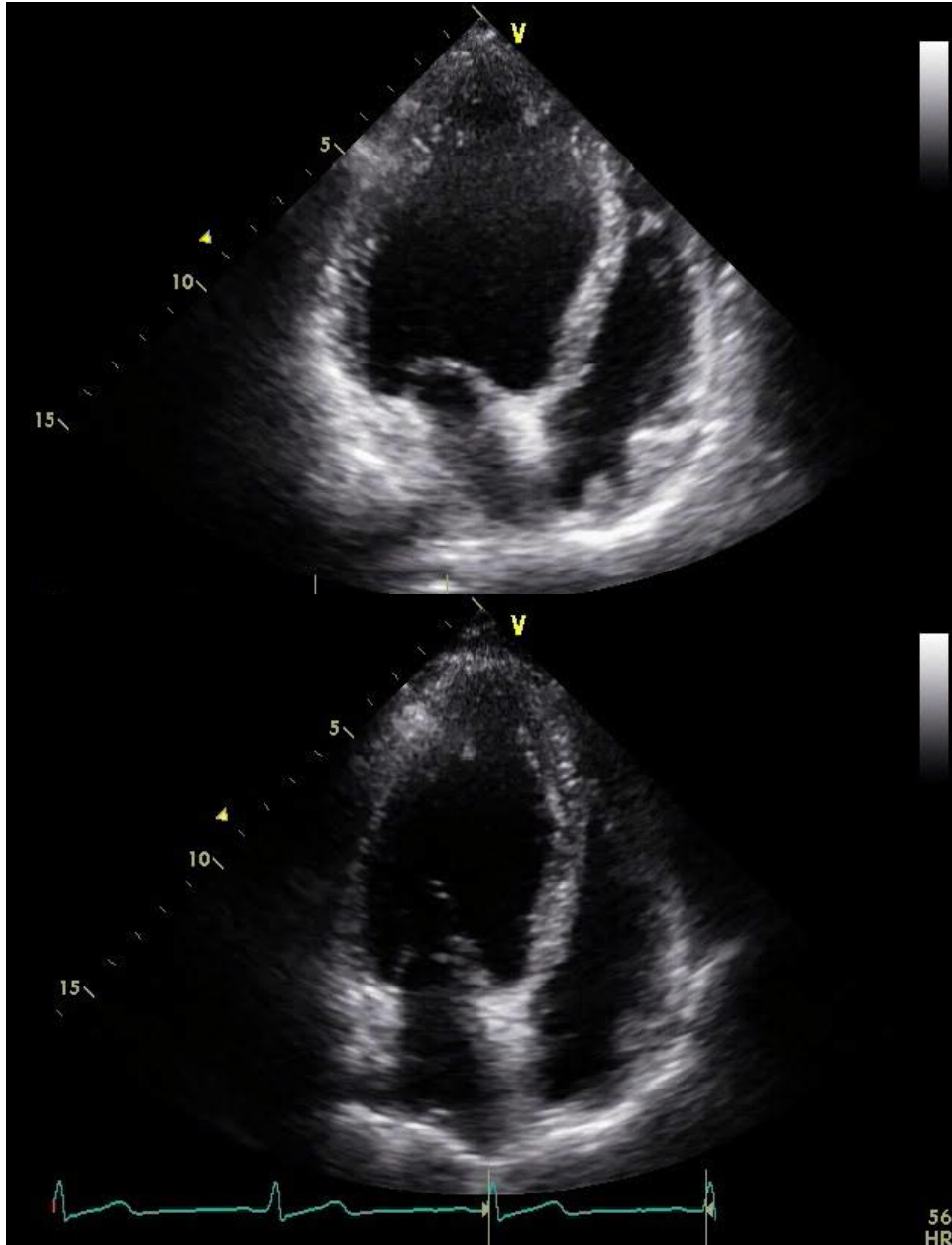


# Stress Echocardiography

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- **Low dose dobutamine:**  
Enhance myocardial contractility
- **High dose dobutamine:**  
Decrease myocardial contractility
- **Biphasic response:**  
Differentiate contractile reserve
- **Sensitivity 75-80%      Specificity 80-85%**

# Stress Echocardiography



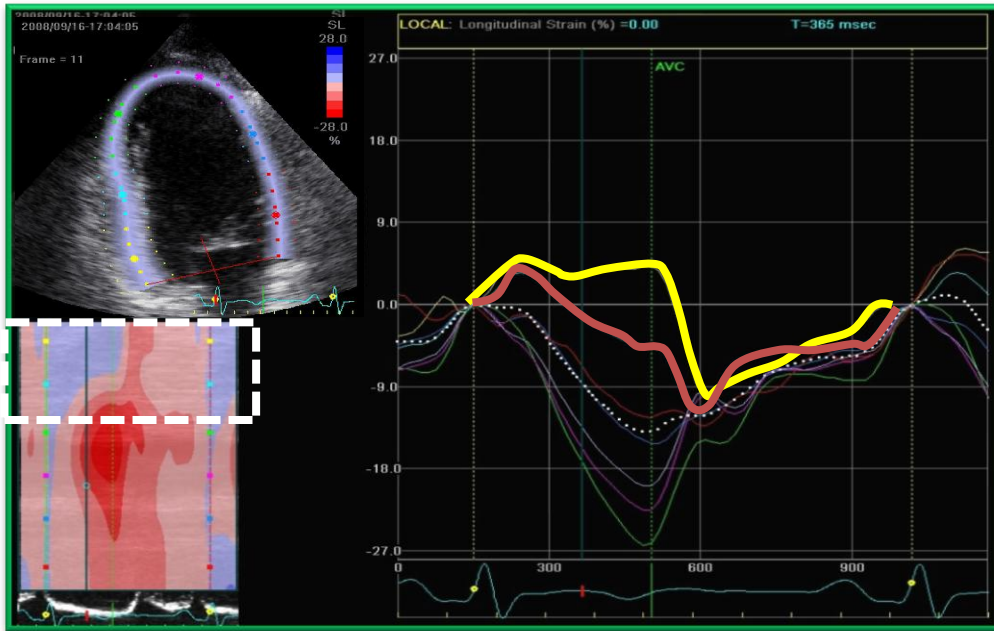
Subtotal stenosis of prox. LAD

# Contrast echocardiography





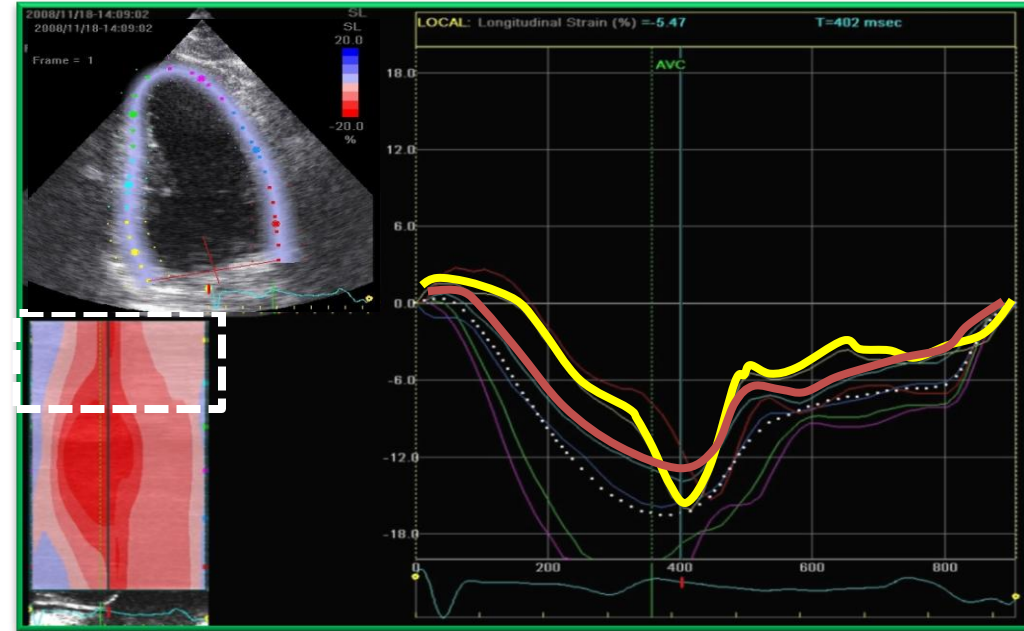
# 2D Strain Imaging for Wall Motion Analysis



Hypokinesia of mid/basal inferior wall

Pre-PTCA of RCA

**Ischemic strain pattern**



Hypokinesia of mid/basal inferior wall

Post-PTCA of RCA

**Recovering strain pattern**

# SPECT

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- **Evaluation of myocardial perfusion and integrity of cell membrane:**  
Thallium-201, technetium-99m sestamibi, technetium-99m tetrofosmin
- **Evaluation of metabolism of myocardium:**  
I-123- $\beta$ -methyl-p-iodophenylpentadecanoic acid (BMIPP)
- **Diagnostic criteria:**  
More than 50-60% trace uptake in segments with decreased systolic function
- **Sensitivity 85-90% Specificity 65-70%**

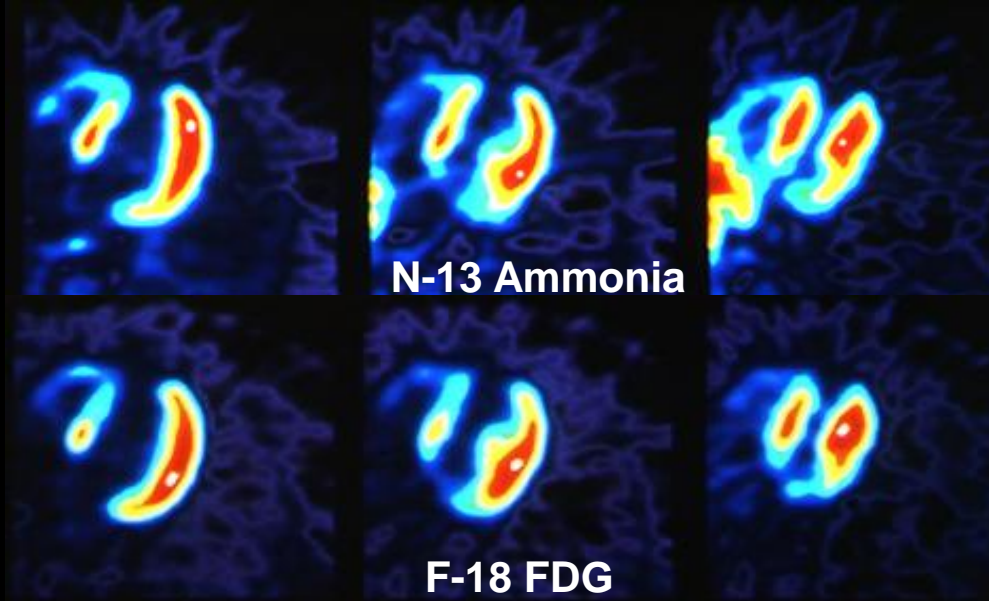
# PET

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- **Evaluation of myocardial perfusion:**  
rubidium-82, oxygen-15 water, nitrogen-13 ammonia
- **Evaluation of metabolism of myocardium:**  
F18-fluorodeoxyglucose, C-11 fatty acid, C-11 acetate
- **Higher sensitivity (85-90%), Lower specificity (70-75%):**
  - Compared with stress echocardiography d/t evaluation method which use criteria of mismatch between myocardial perfusion and metabolism
  - No consideration of contractile reserve

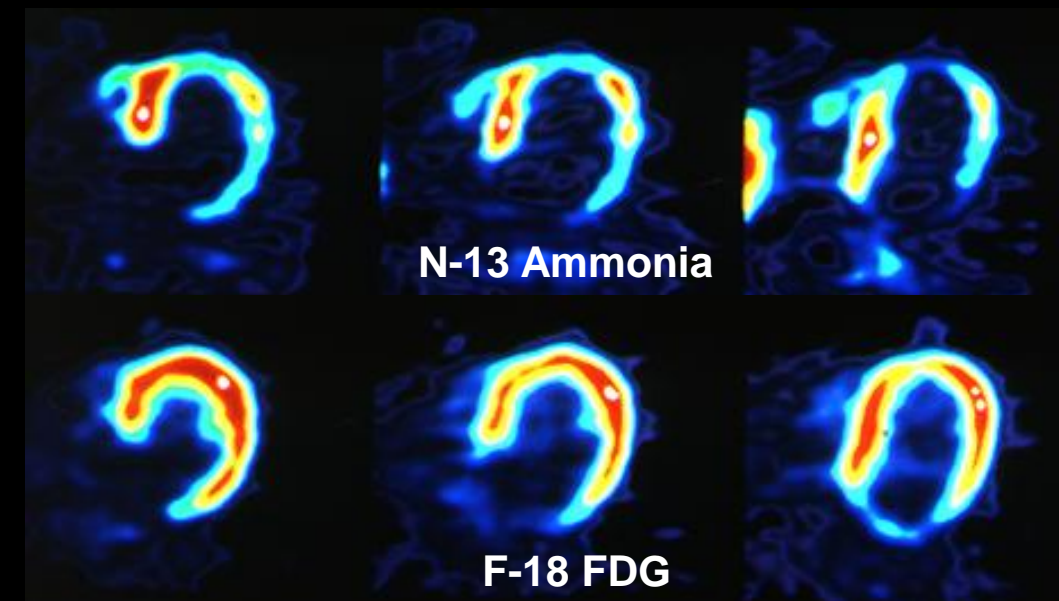
# Patterns of myocardial viability by use of myocardial perfusion and FDG PET

Matched Defect



*Non-viable Necrotic Myocardium*

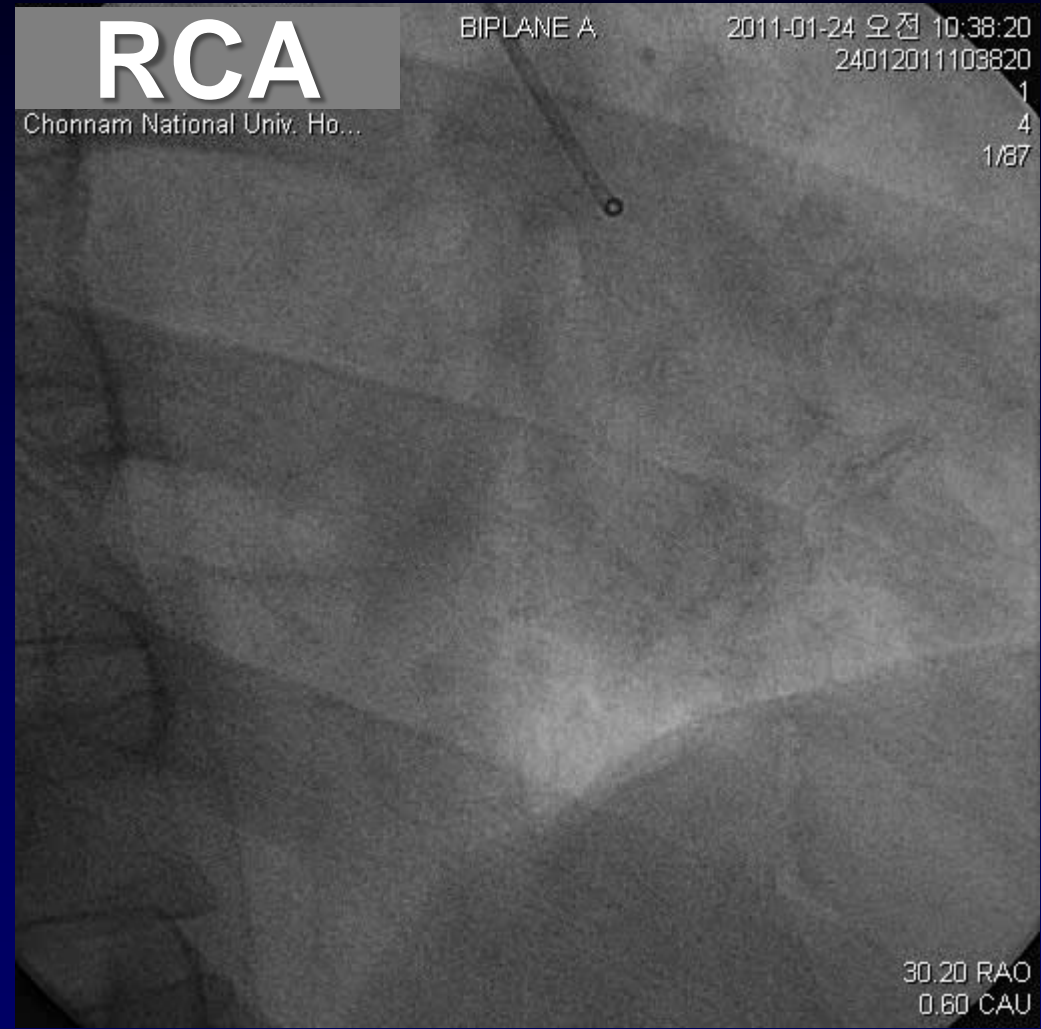
Mismatched Defect



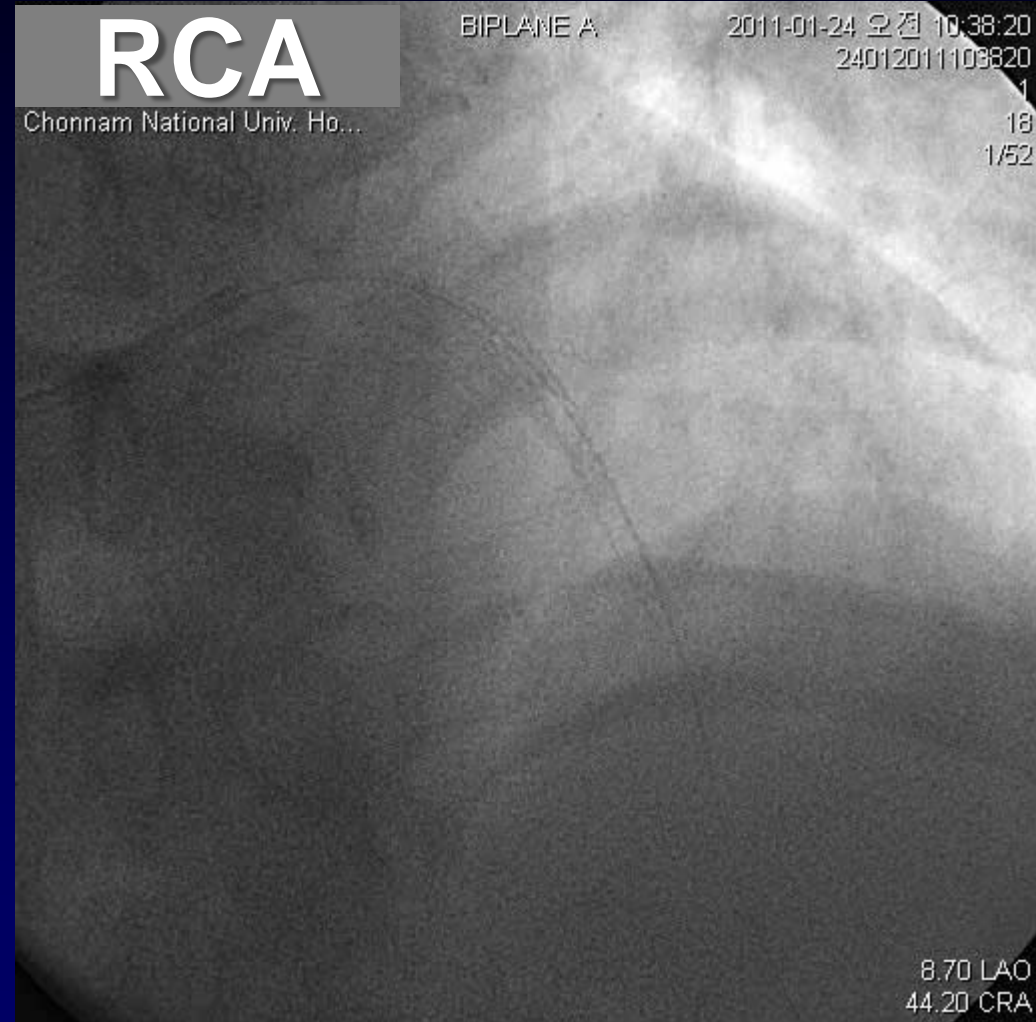
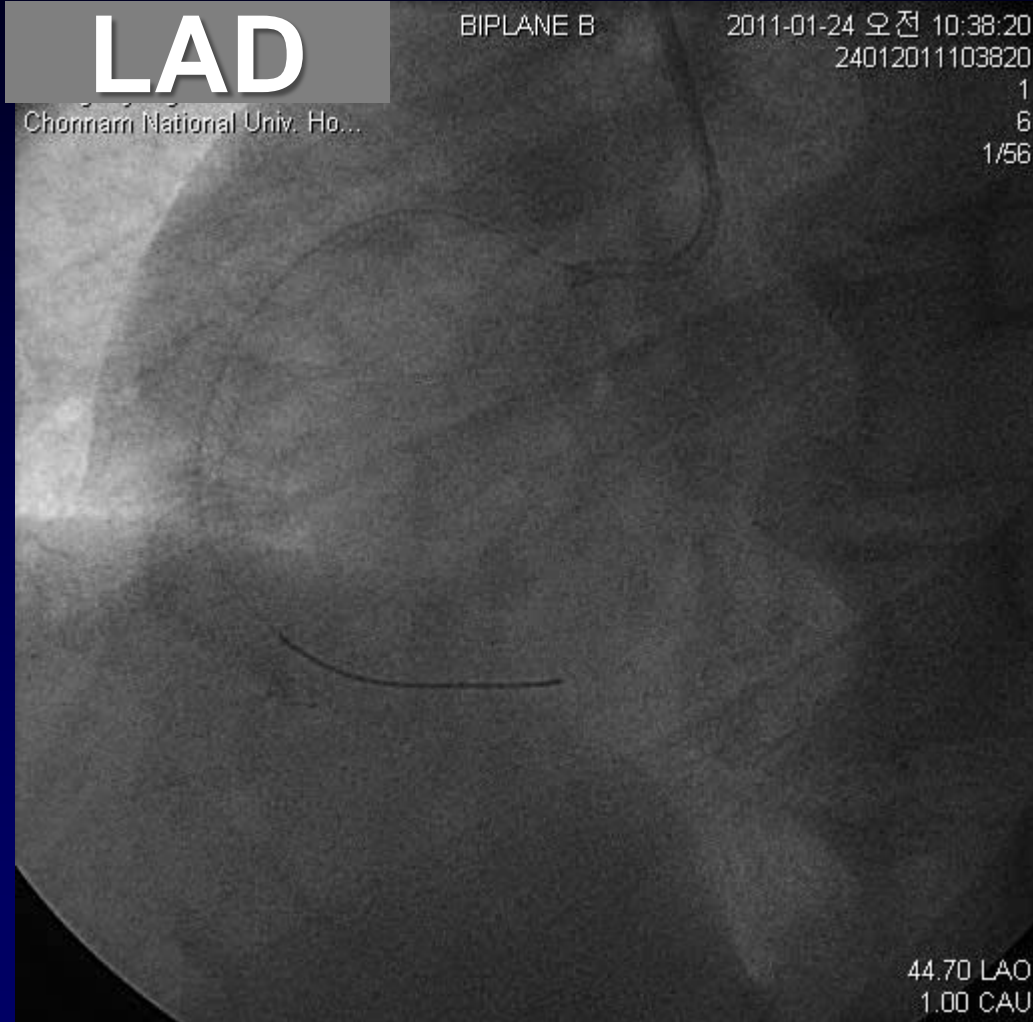
*Viable Hibernating Myocardium*



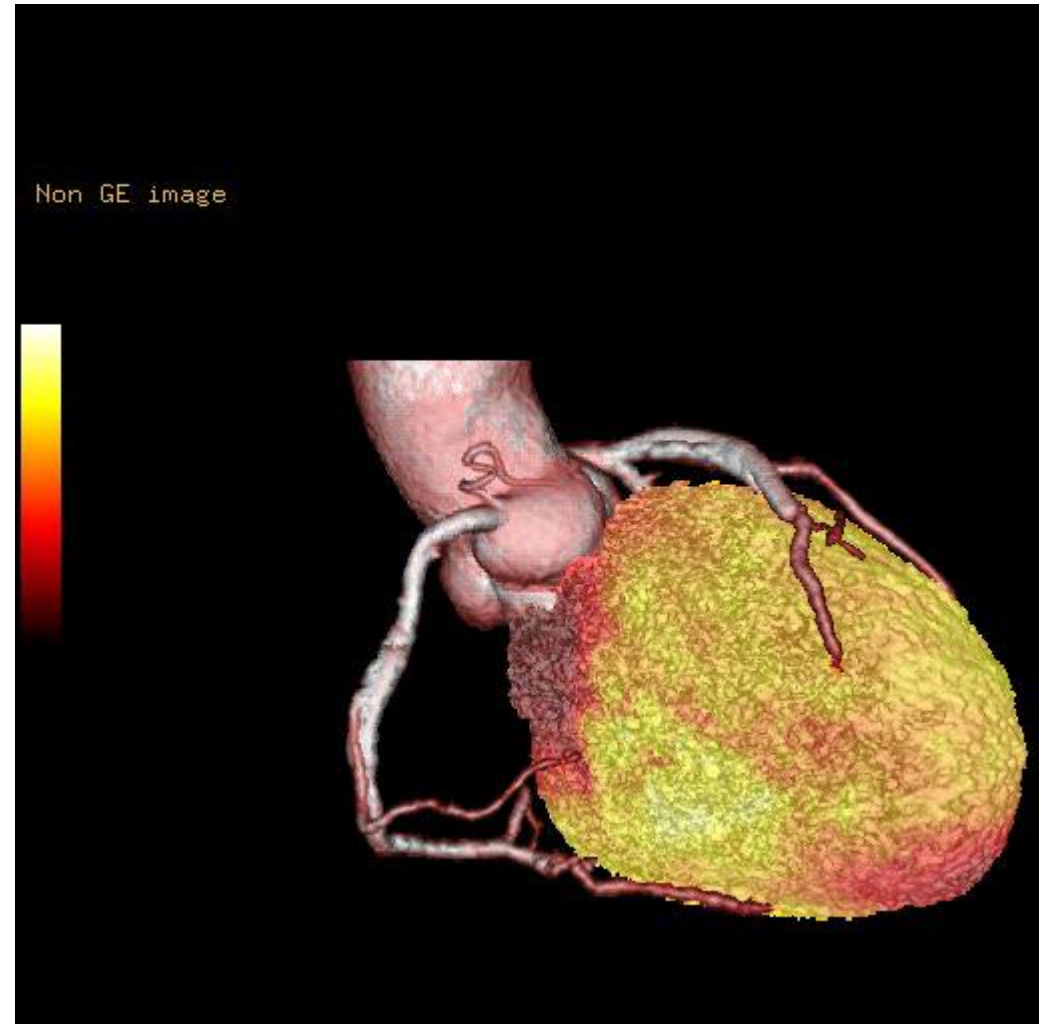
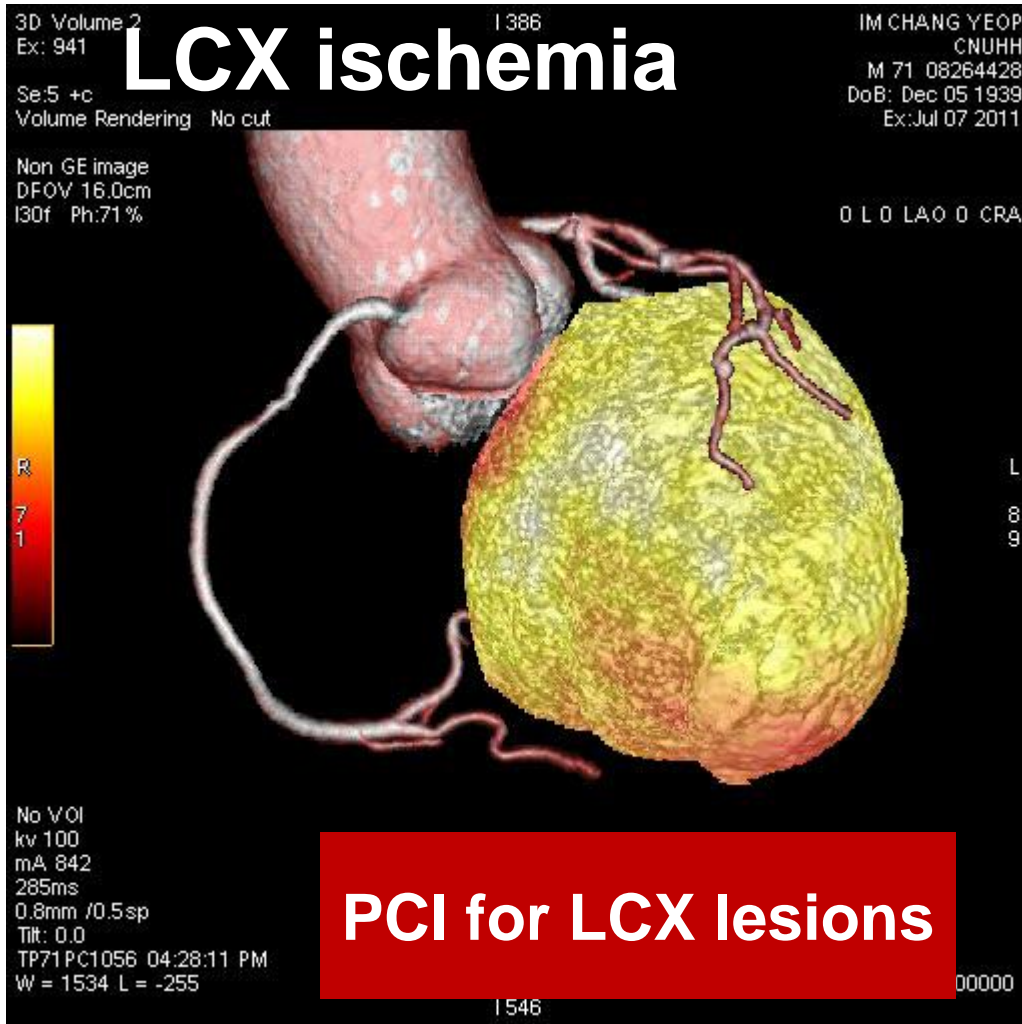
# Coronary angiogram



# Coronary angiogram



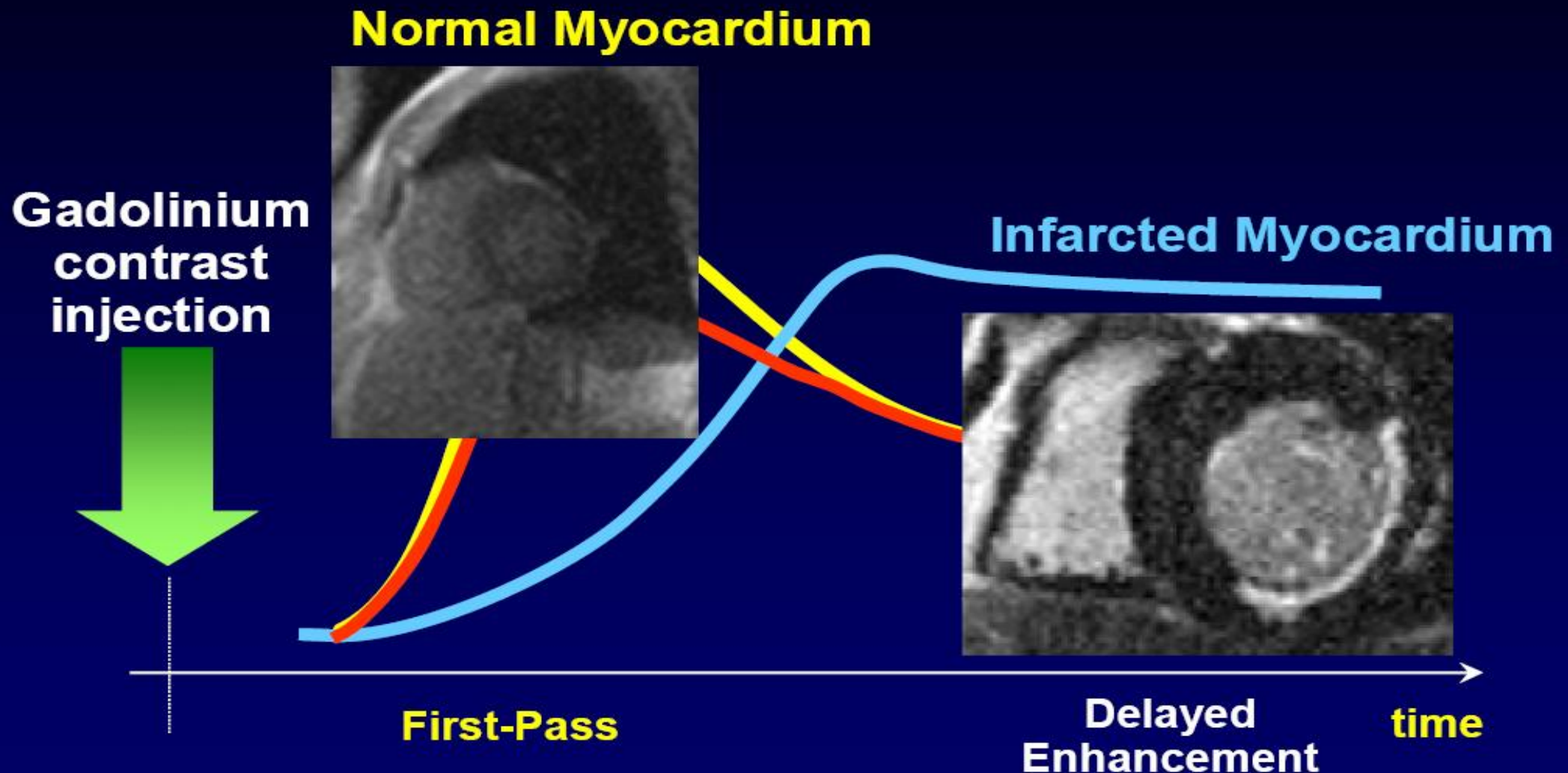
# Ammonia-PET/CT for intermediate lesion Vs. FFR



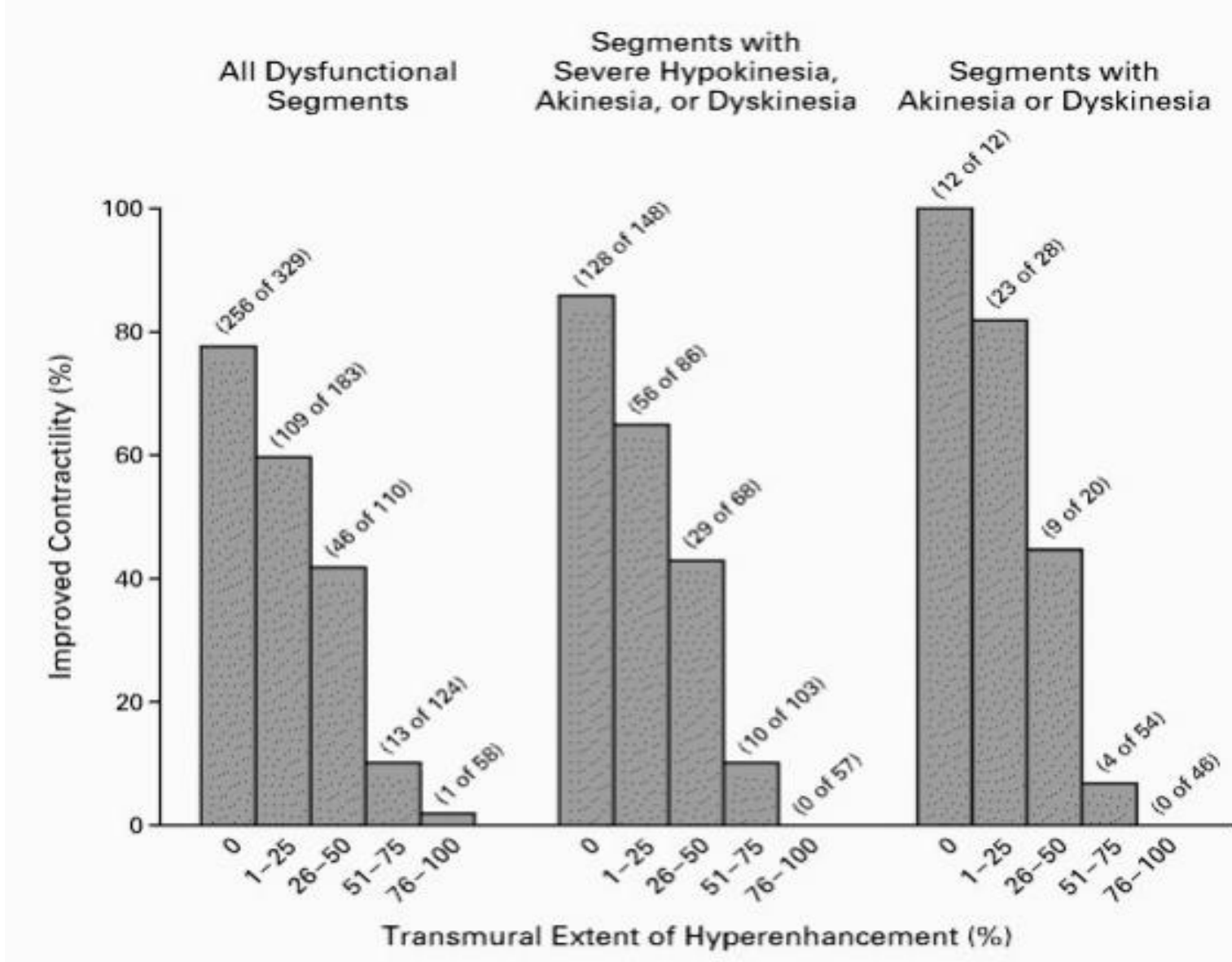
*CNUH data*



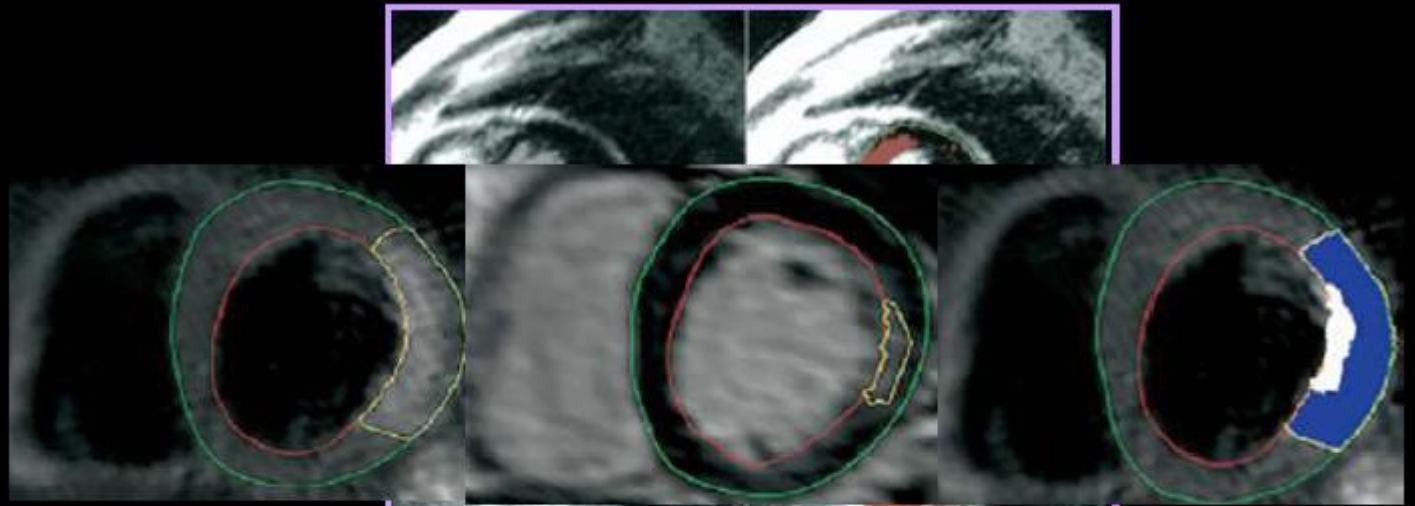
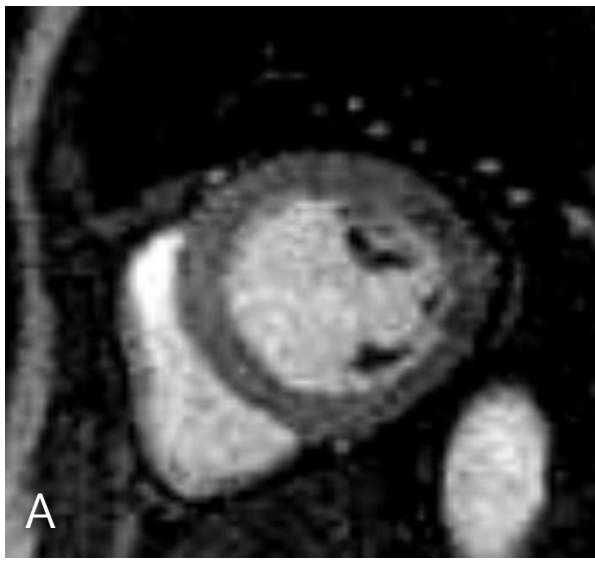
# MRI: Perfusion & Viability



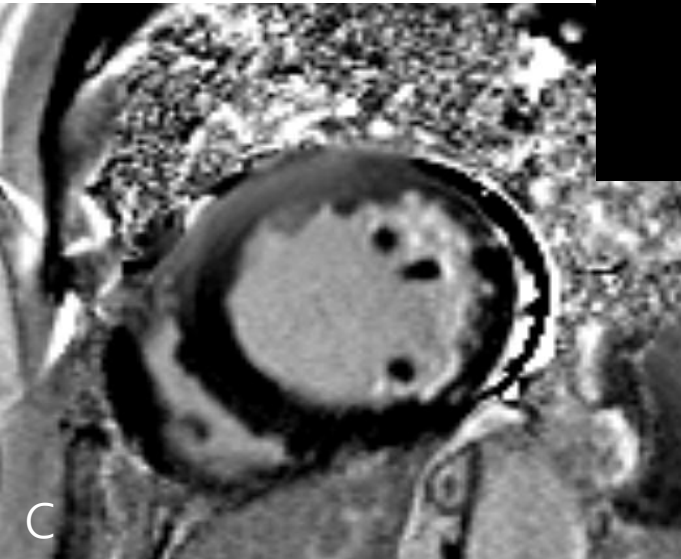
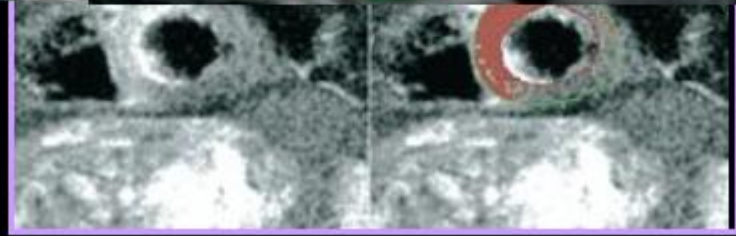
# DE-MRI vs. Functional Recovery





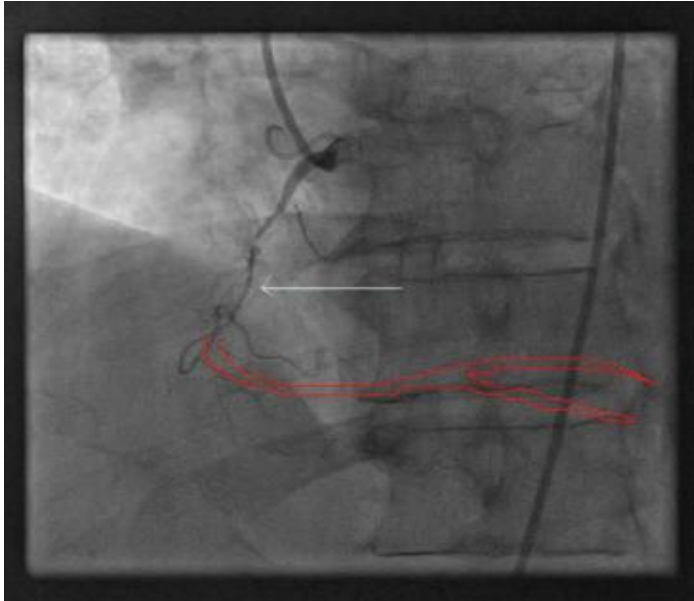


T2 Imaging



CNUH data

# CTO



➤ Exist in 1/3 multivessel disease pts

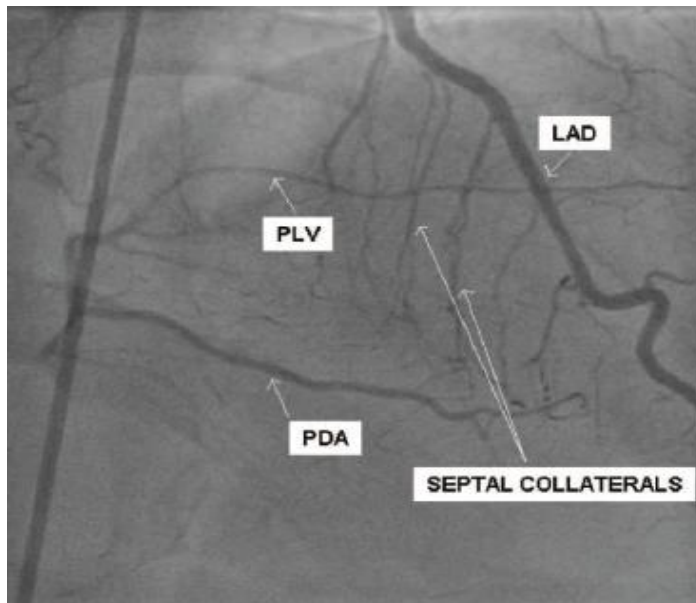
➤ Occurs d/t

1. Gradual total obstruction by atherosclerosis

2. Fibrosis of thrombus after MI  
=> Usually combines systolic dysfunction

➤ Develop collateral circulation

➤ CTO also has hibernating myocardium



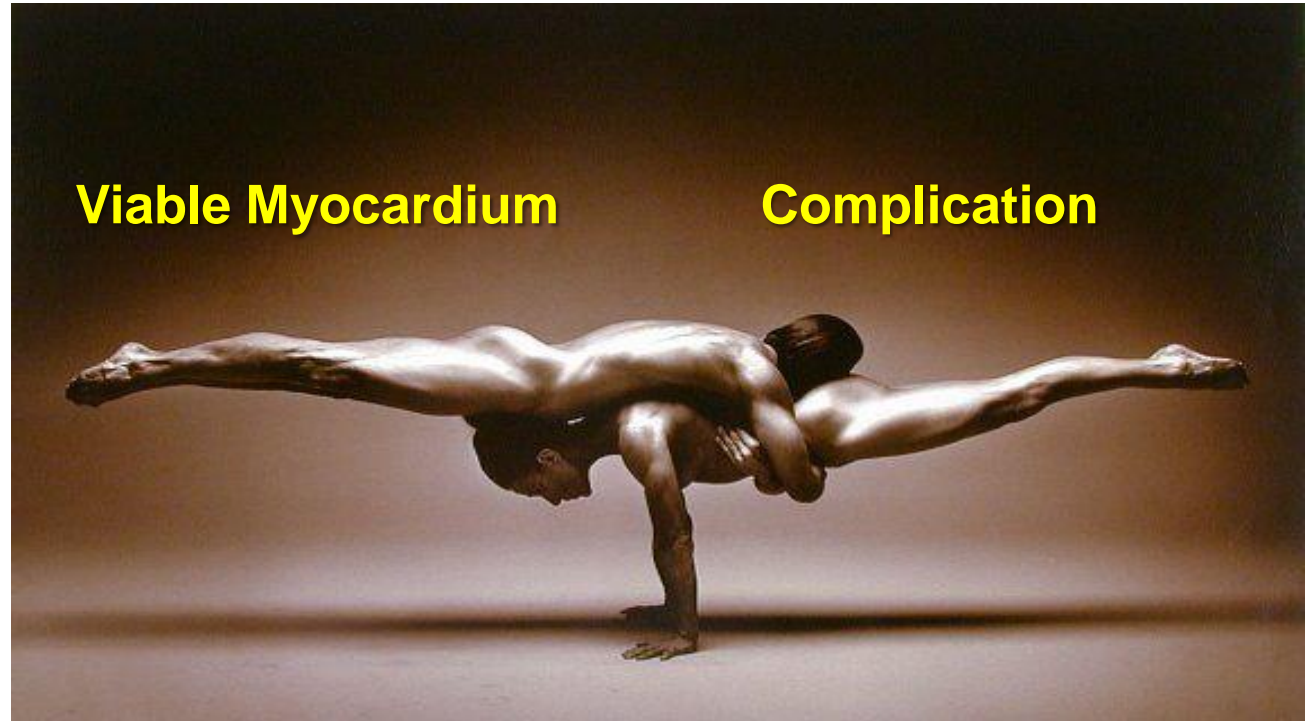
# CTO PCI in patients with ICMP

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- **ACS in collateral circulation:**
  - Prevent lethal results
  - Prepare myocardial reserve
- **In situation of more than 1/3 endomyocardial fibrosis in ICMP pts:**
  - Less expectation of systolic function recovery
  - Revascularization of remained 2/3
  - Prevent myocardial remodeling
  - Improve diastolic dysfunction
  - Decrease mortality d/t ventricular arrhythmia
- **Improve systolic function**
- **Improve chest pain**
- **Decrease mortality**
- **Improve QOL**

# CTO PCI in ICMP Pts

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# Method of revascularization of advanced CAD

## ICMP Pts with following disease status

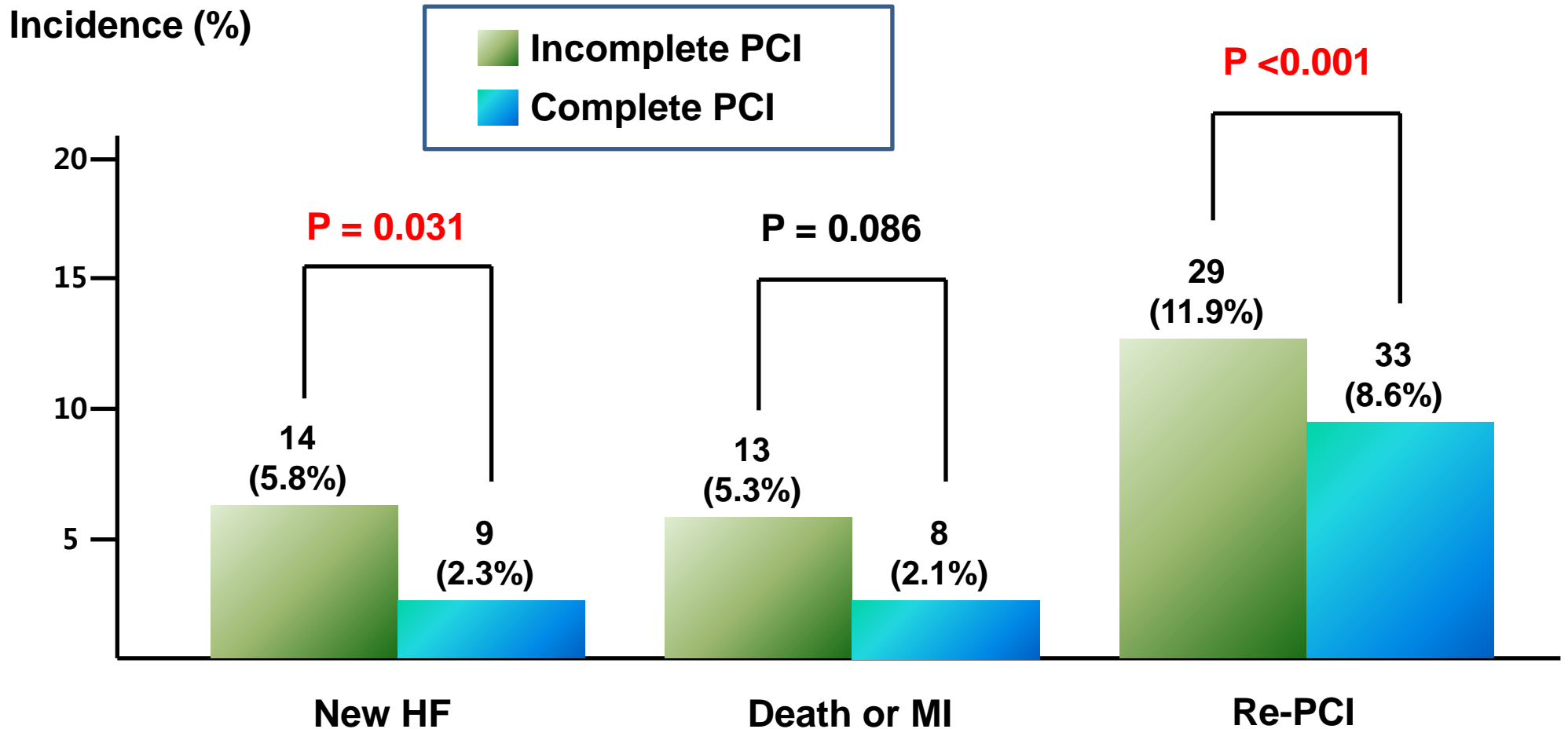
	PCI	CABG
➤ 2 vessel CAD with prox. LAD stenosis	A	A
➤ 3 vessel CAD with prox. LAD stenosis	U	A
➤ Isolated LM stenosis	I	A
➤ LM stenosis and additional CAD	I	A
➤ Prior bypass surgery with native 3 vessel disease and failure of multiple bypass grafts ➤ LIMA remains patent to a native coronary artery	A	U
➤ Prior bypass surgery with native 3 vessel disease and failure of multiple bypass grafts ➤ LIMA was used as a graft but is no longer functional	U	A

A: appropriate    U:uncertain    I: inappropriate



# Incomplete revascularization predict ICMP in AMI

## NSTEMI One-year clinical outcomes



**Percutaneous Coronary Intervention for Unprotected Left Main  
Coronary Artery Disease in Patients with Acute Myocardial Infarction**

**High overall mortality  
in-hospital (11.1 %) and  
at 12 months (20.4 %)**

# **Delayed-Enhanced MDCT Immediately After Primary Percutaneous Coronary Intervention for Acute Myocardial Infarction Is Useful in Assessing Infarct Extent**

**First acute STEMI within 12 hrs of symptom onset**

**40 consecutive patients (32 men,  $59 \pm 3$  yrs)**

**DE 64-slice MDCT after primary PCI (<30 min) without additional contrast injection**

- Atenolol 50-100 mg to slow HR <65 beats/min**
- Retrospective ECG-gated scan with ECG-dose modulation**
- 120 kVp / 600 mAs, 4.5 mSv**

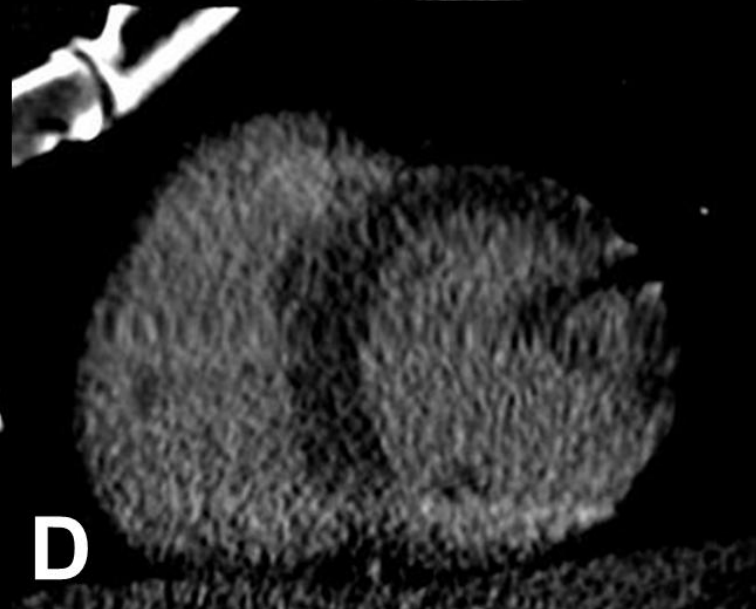
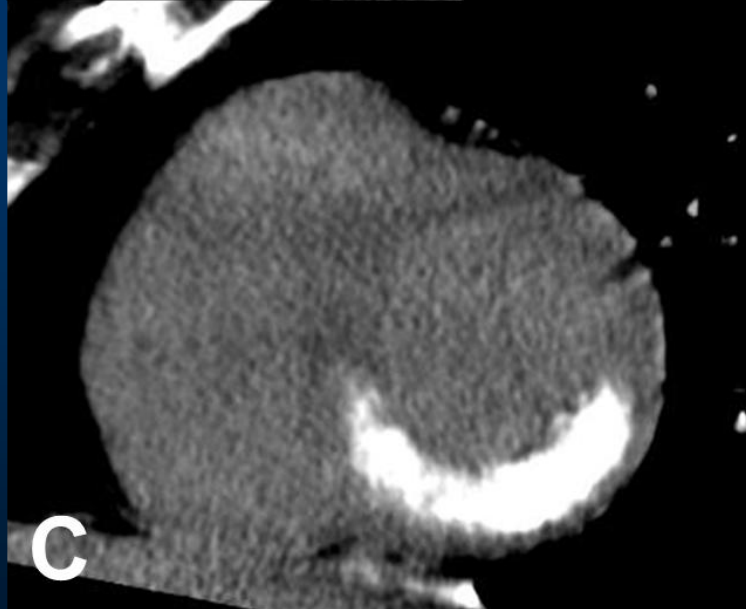
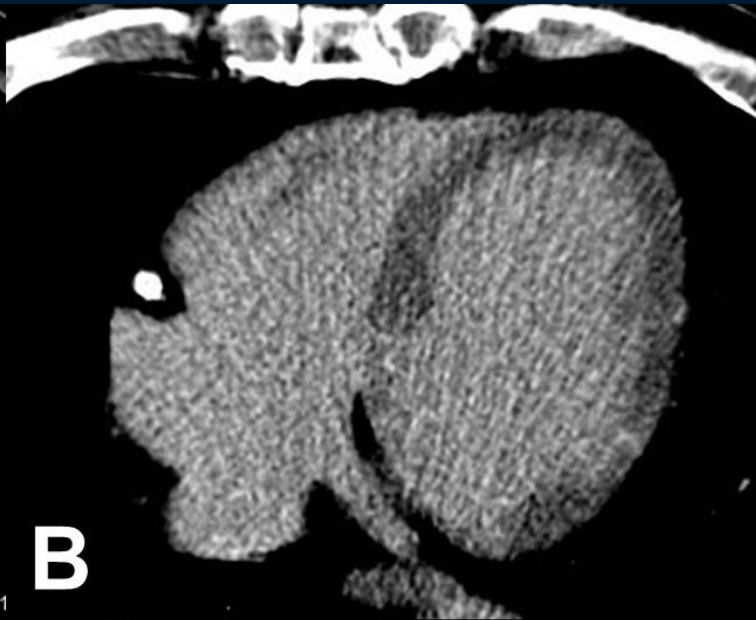
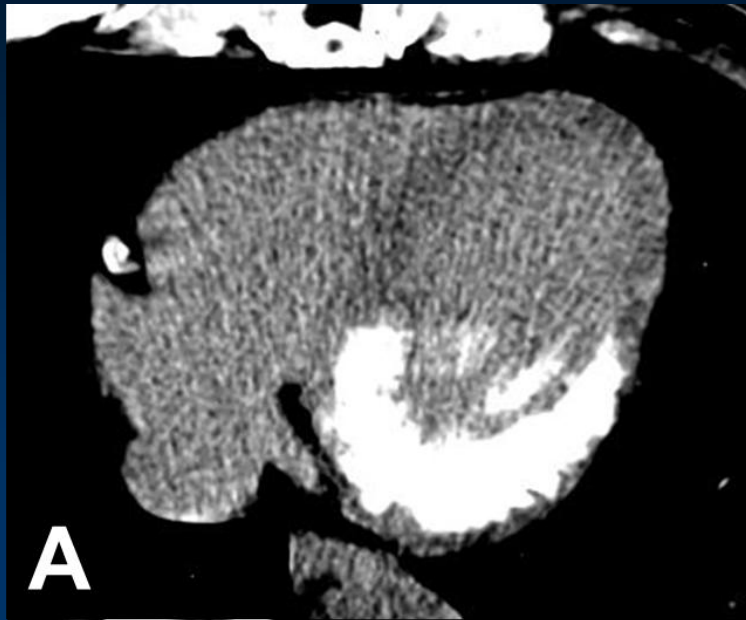
**Infarct size as total vol. of myocardium showing DE**

**Extent of initial ST-segment elevation on ECG**

**Cardiac biomarkers before PCI & serially up to 36 hrs**

**Immediately after PCI**

**2 months after PCI**



**Infarct size = 37 mL**

**Infarct size = 23 mL**

# NT-ProBNP and Indices of Infarct Size, LV Function and Volume

	NT-proBNP					
	At admission		24 hours		2 months	
	r	p	r	p	r	p
<b>Peak Tn-I</b>	- 0.041	0.696	0.263	<b>0.026</b>	0.495	<b>&lt;0.001</b>

The changes of various cytokines from peripheral blood and their relationship with LV systolic function in patients with AMI who underwent successful PCI:

Especially, **SCF** could be a predictor for LV systolic function recovery after AMI.

Manuscript preparation

<b>2 months</b>	0.004	0.049	0.150	0.430	0.470	<b>0.027</b>
<b>LVESVI</b>						
Baseline	0.023	0.876	0.263	0.111	0.362	0.076
<b>2 months</b>	0.176	0.344	0.350	0.073	0.647	<b>0.001</b>



# Optimal candidate for PCI in ICMP Pts

ICMP Pts

Hibernating myocardium?

Stress Echocardiography, SPECT, PET, cardiac MRI

경청해 주셔서 감사합니다.

1 vessel

2 vessel

3 vessel

LM

LM + additional CAD

Prox.LAD

Prox.LAD

No

Yes

No

Yes

PCI:  
Possible

PCI:  
Appropriate

PCI:  
Possible

CABG