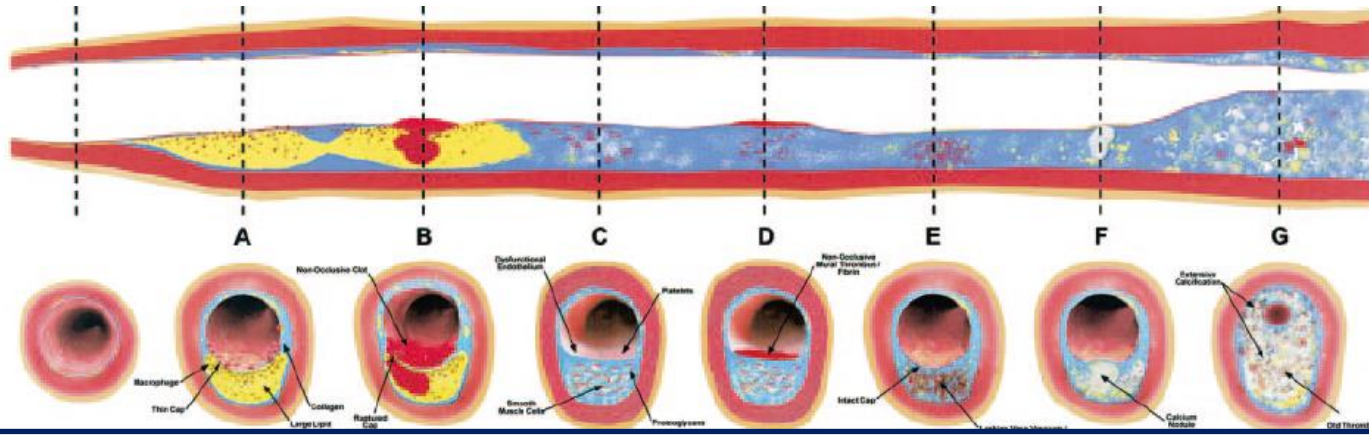# Case matched vulnerable myocardium detection: Non-invasive cCTA and FMM

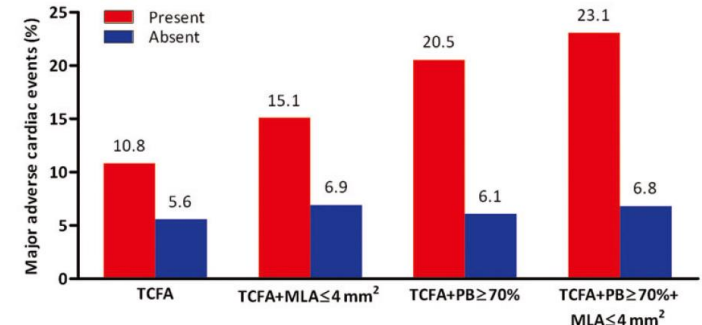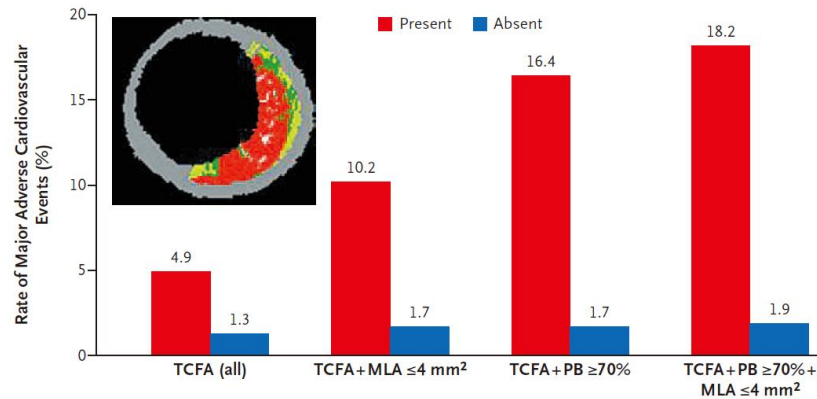**Doyeon Hwang, MD**

Seoul National University Hospital

Plaque morphology and clinical outcome

**Vulnerable plaque characteristics are associated with worse clinical outcome.**

	TCFA (all)	TCFA+MLA ≤4 mm²	TCFA+PB ≥70%	TCFA+PB ≥70%+ MLA ≤4 mm²
Lesion hazard ratio (95% CI)	3.90 (2.25–6.76)	6.55 (3.43–12.51)	10.83 (5.55–21.10)	11.05 (4.39–27.82)
P value	<0.001	<0.001	<0.001	<0.001
Prevalence (%)	46.7	15.9	10.1	4.2

	TCFA		TCFA+MLA≤4 mm²		TCFA+PB≥70%		TCFA+PB≥70%+ MLA≤4 mm²	
95% CI lower limit (%)	6.9	3.1	6.1	4.7	10.9	3.9	9.0	4.6
95% CI upper limit (%)	14.7	8.1	24.1	9.1	30.1	8.3	37.2	9.0
Prevalence (%)	41.7	58.3	10.5	89.5	11.9	88.1	6.0	94.0
No. at risk at 1 year (n)	211	312	50	473	52	471	52	471
Hazard ratio (95% CI)	1.96 (1.08-3.53)		2.26 (1.09-4.69)		3.47 (1.86-6.49)		3.70 (1.72-7.95)	
P-value	0.024		0.025		<0.001		<0.001	

Circulation. 2003;108:1664-1672. N Engl J Med. 2011 Jan 20;364(3):226-35. Eur Heart J. 2014 Mar;35(10):639-47.

Plaque evaluation from cCTA

Coronary CT angiography is also useful to evaluate
the vulnerable plaque.
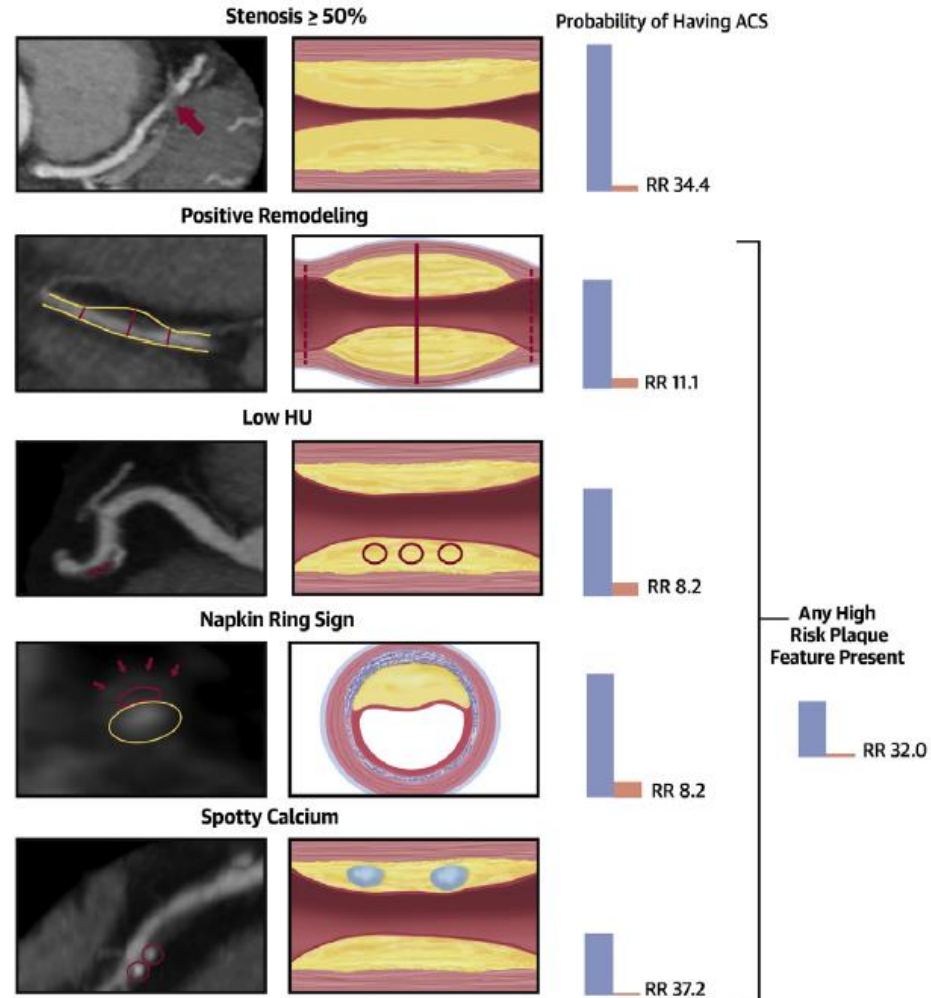
The Amount of Subtending Myocardium

- Moderate to severe ischemia, defined as ≥10% ischemic myocardium, is associated with better clinical outcomes after revascularization.
- It is important to consider the subtending myocardium of the lesion for the treatment strategy.

Circulation. 2003;107:2900-2906.
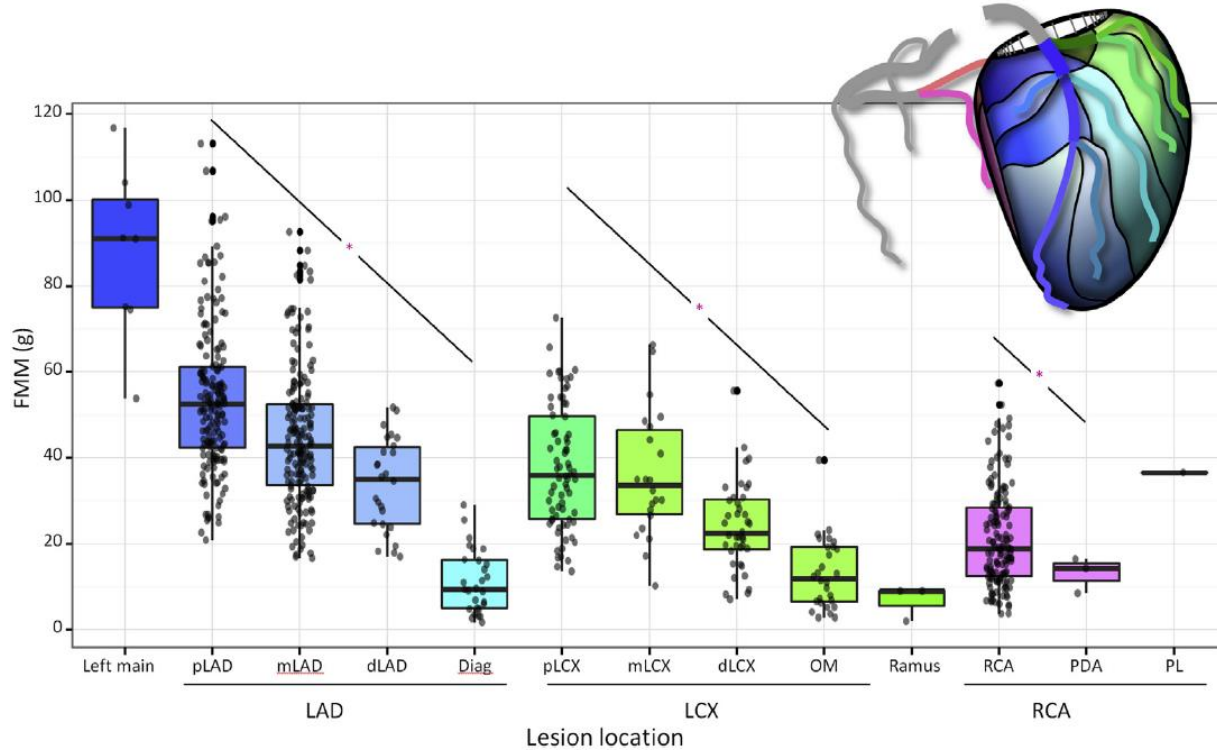Circulation. 2008;117:1283-1291.
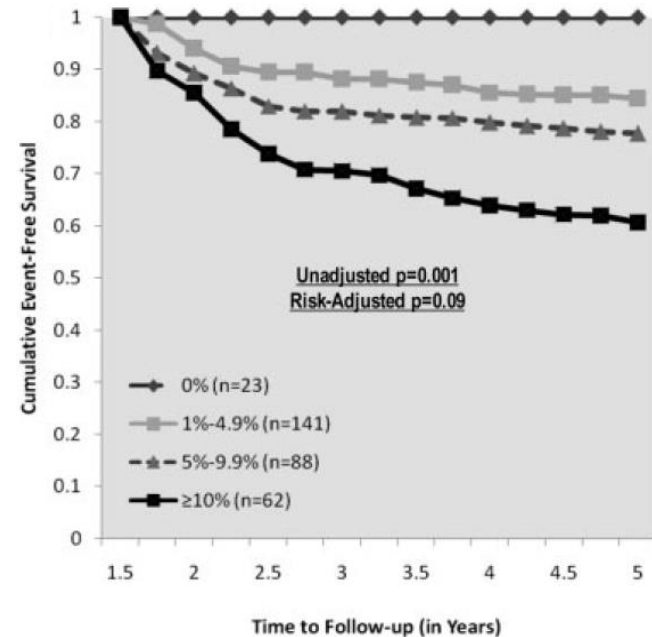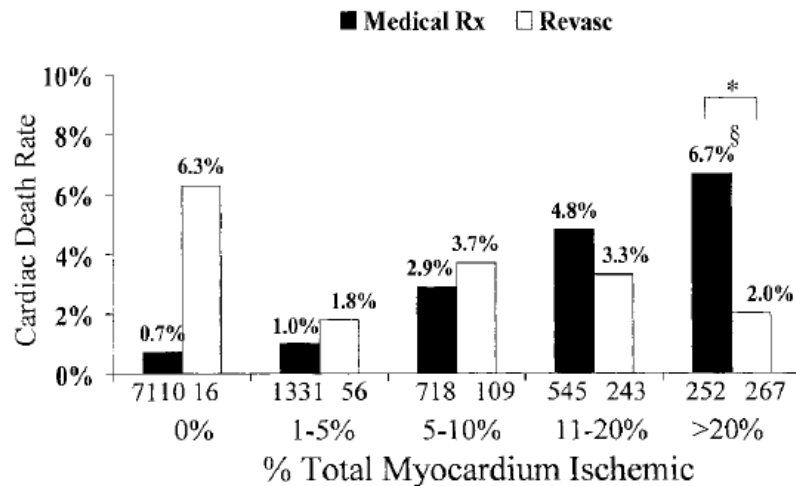
The Concept of Fractional Myocardial Mass

- A vessel-specific amount of myocardium derived from coronary computed tomography angiography (CCTA)
- Using a stem-and-crown model
- Based on allometric scaling law between length of coronary arterial tree and LV myocardial mass
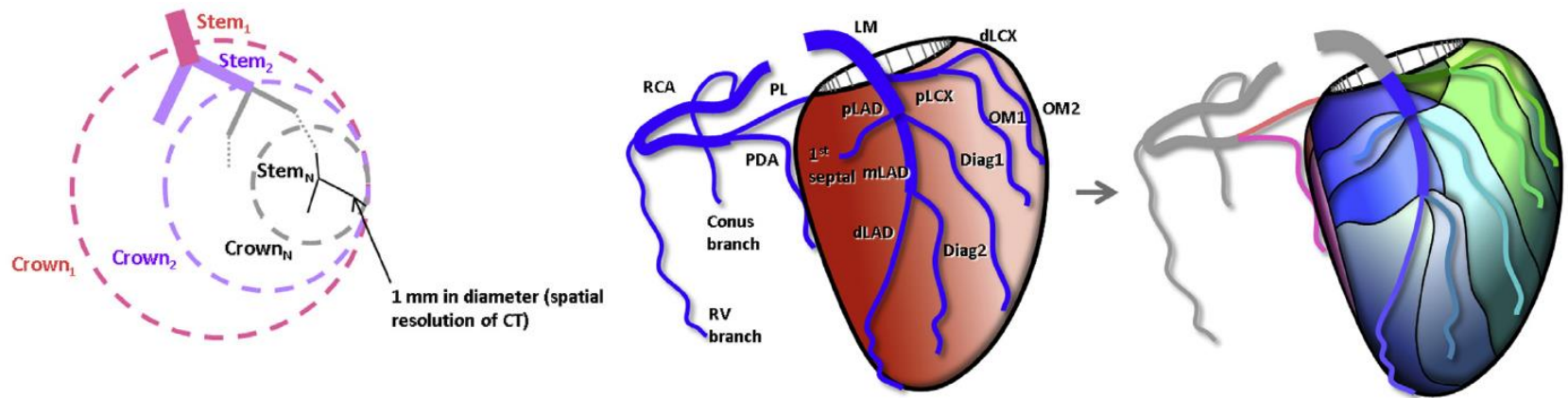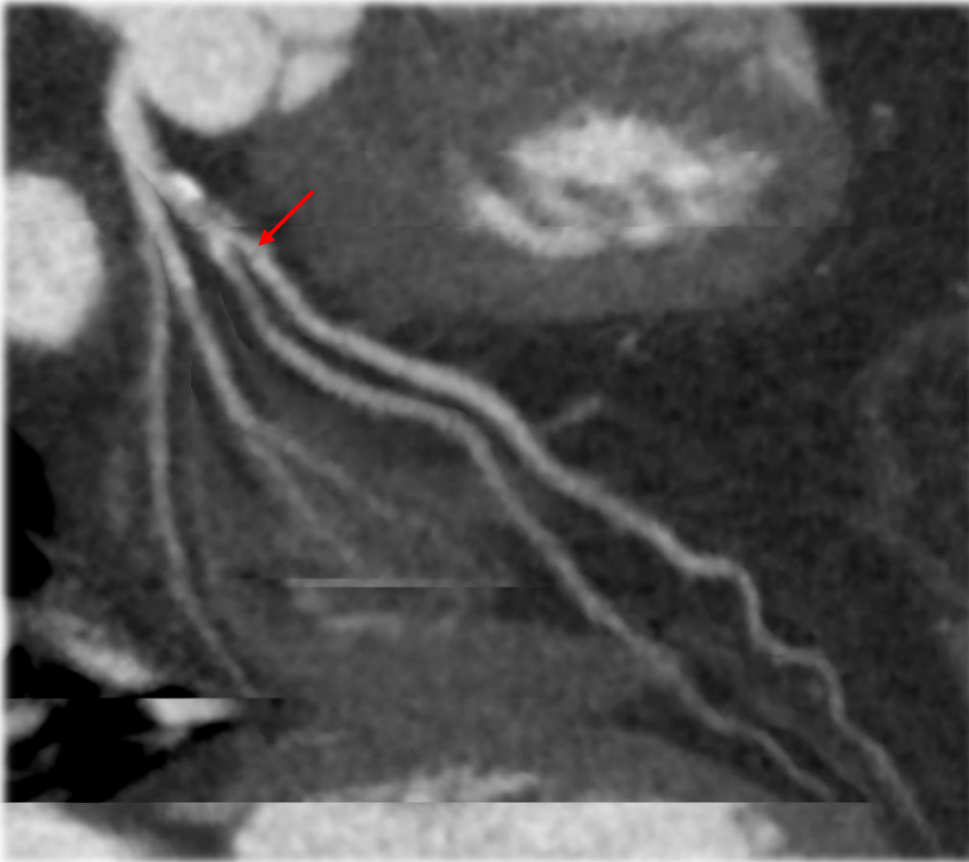
Fractional Myocardial Mass (FMM)

Predictors for FMM > 10% →

|	Odds Ratio ± SE	p Value
Side branch length ≥ 73 mm	41.9 ± 2.1	<0.001
Left main bifurcation	345.2 ± 2.9	<0.001
Reference vessel diameter ≥ 2.68 mm	1.5 ± 1.9	0.73
Left ventricular mass > 104.8 g	1.4 ± 1.8	0.61
Fractional flow reserve < 0.80	2.3 ± 2.2	0.24

Back to the Case

LAD and LCX

Proximal LAD, Calcified plaque
55 % diameter stenosis
Diagonal branch, non-calcified plaque
45 % diameter stenosis

RCA

Proximal RCA, Calcified plaque
40 % diameter stenosis

Calculation of FMM
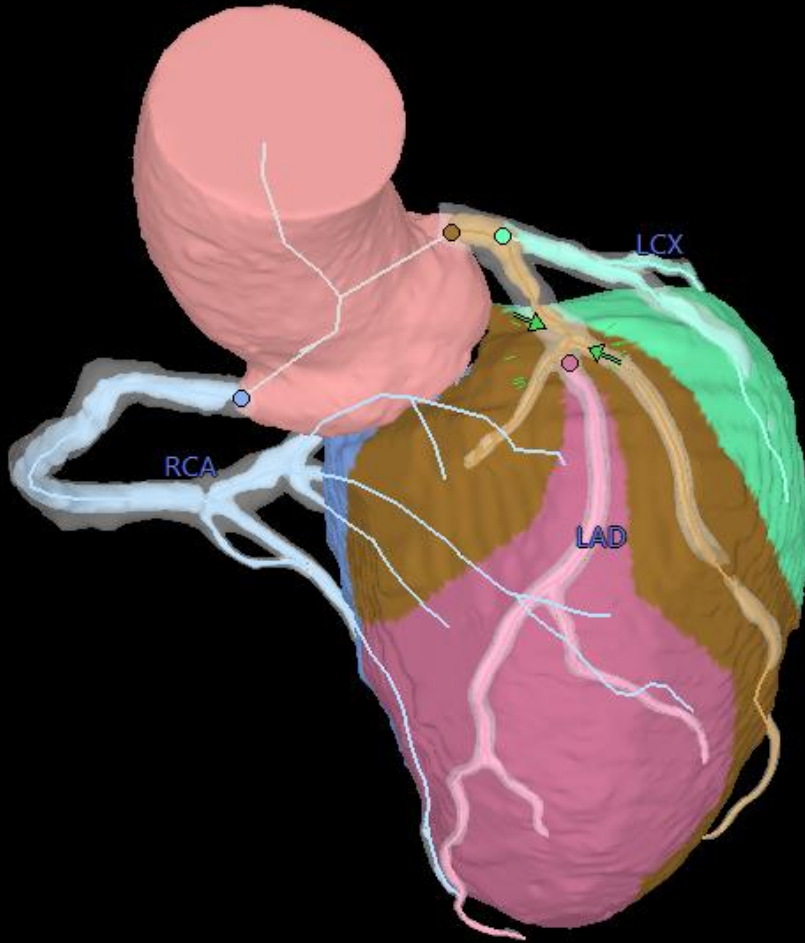
FMM values in this case

LV mass	= 84 g
proximal LAD	= 32 g (39%)
Diag 1	= 11 g (13%)
Mid LAD	= 19 g (23%)
RCA	= 16 g (20%)

Summary

- Coronary CT angiography provides various information about the coronary lesion, including lesion severity, morphology, plaque characteristics and fractional myocardial mass.

- Before entering the catherization laboratory, we can plan treatment strategy using coronary CT angiography.

- In this case,
  Proximal LAD, Calcified plaque, 55 % diameter stenosis (%FMM 39%)
  Diagonal branch, non-calcified plaque, 45% diameter stenosis (%FMM 13%)
  Proximal RCA, Calcified plaque, 40 % diameter stenosis (%FMM 20%)

- **What will you plan for treatment using these information?**