

IV OCT in Clinical CAD

: 1400 patients

Feasibility, Predictability, Preventability, Futurability

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Disclosure

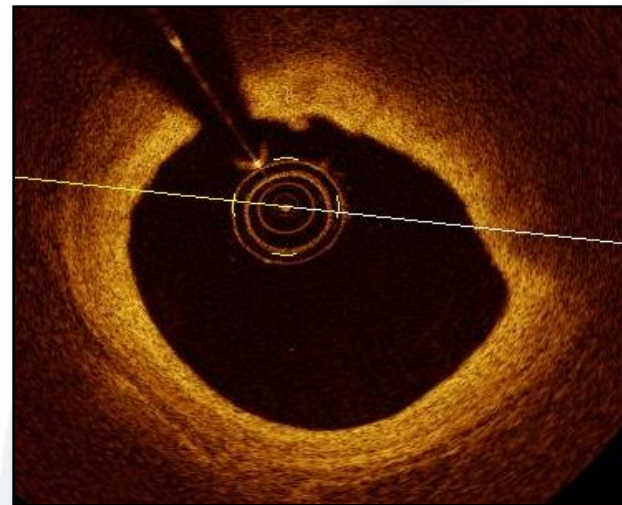
- Research grant: Abbott Laboratories, Medicare
- Honorarium: Abbott Laboratories



Vulnerable Plaque (High-Risk Plaque)

“A plaque that is prone to disruption, but has not been disrupted yet.”

- Rupture: 60-70%
 - Thin fibrous cap
 - Lipid rich plaque
 - Macrophage
 - Neovascularization
 - Positive remodeling
- Erosion: 30-35%
- Calcified nodule: 3-8%
- Others (SCAD, etc)



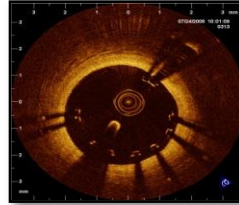
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IV Diagnostics for Vulnerable Plaque

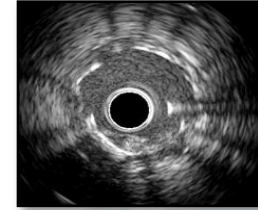
Modality	Cap	Lipid	MΦ	Microvessels	Remodeling/Plaque burden
GS IVUS	+	+	-	+	+++
VH IVUS	+	+ / +++	-	+	+++
NIRS IVUS	+	++	-	+	+++
OCT	+++	++	+	++	-

Ong D, Jang IK. *Nature Rev Cardiol* 2015

OCT

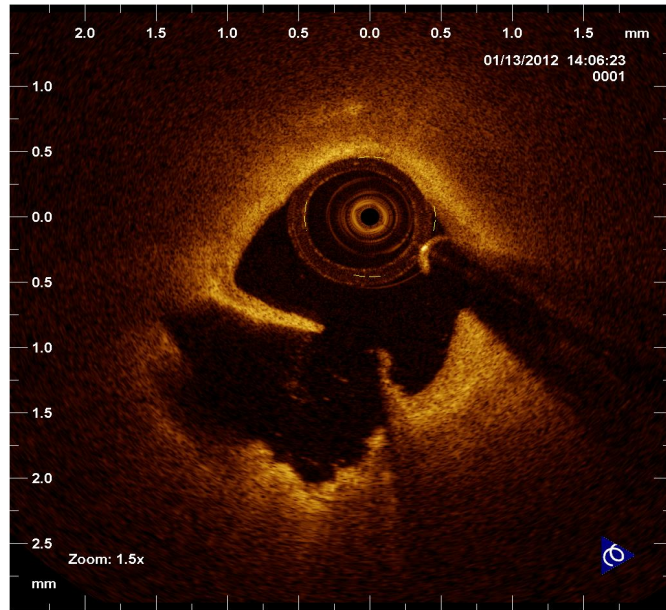


IVUS

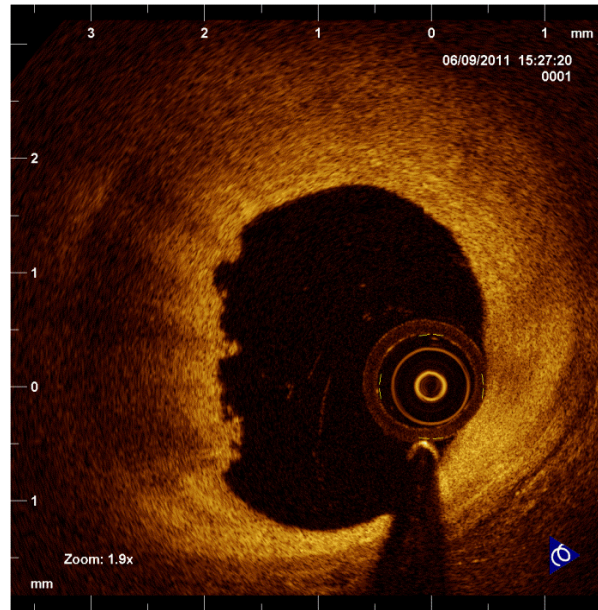


<i>Axial Resolution</i>	12 - 15 μm	100 - 200 μm
<i>Beam Width</i>	20 – 40 μm	200 – 300 μm
<i>Frame Rate</i>	100 frames/s	30 frames/s
<i>Pullback Speed</i>	20 - 30 mm/s	0.5 - 1 mm/s
<i>Scan Diameter</i>	10 mm	15-20 mm
<i>Tissue Penetration</i>	1.0 - 2.0 mm	10 mm
<i>Lines per Frame</i>	500	256
<i>Lateral Sampling (3mm Artery)</i>	19 μm	225 μm
<i>Blood Clearing</i>	Required	Not Required

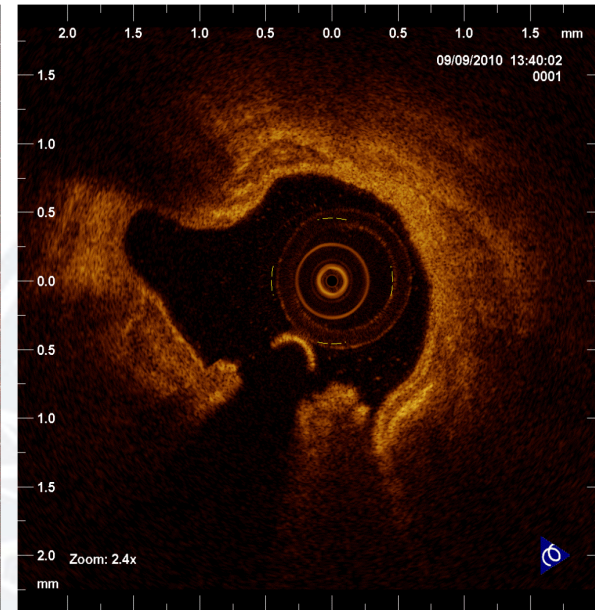
Rupture



Erosion



Ca nodule



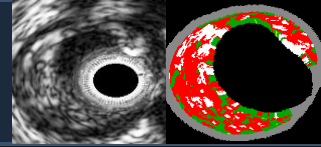
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Local Detection of VP/HRP

- Why trying to detect “vulnerable plaque” using an intravascular modality?
- Only when a local treatment is considered.



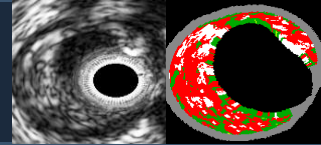
PROSPECT: MACE



3-year follow-up, hierarchical

	All	Culprit lesion related	Non culprit lesion related	Indeter- minate
Cardiac death	1.9% (12)	0.2% (1)	0% (0)	1.7% (11)
Cardiac arrest	0.3% (2)	0.3% (2)	0% (0)	0% (0)
MI (STEMI or NSTEMI)	2.7% (17)	1.7% (11)	1.0% (6)	0.2% (1)
Rehospitalization for unstable or progressive angina	15.4% (101)	10.4% (69)	10.7% (68)	0.8% (5)
Composite MACE	20.4% (132)	12.9% (83)	11.6% (74)	2.7% (17)
Cardiac death, arrest or MI	4.9% (31)	2.2% (14)	1.0% (6)	1.9% (12)

PROSPECT: Questions



Was 3-vessel VH-IVUS imaging safe?

Complications adjudicated to the 3-vessel IVUS imaging procedure (n=697)

Death	0 (0%)
MI	3 (0.4%)
- Q-wave (from dissection)	1
- non Q-wave (from dissection)	2
PCI or CABG	10 (1.4%)
- CABG (from perforation)	1
- CABG (from dissection)	2
- PCI (from dissection)	9
Any imaging complication*	11 (1.6%)

PROSPECT: Take home message

- Potential prevention of MI (STEMI + NSTEMI) in 1% of patients undergoing 3 vessel imaging.
- Risk of 3 vessel imaging is 1.6%.
- → 3 vessel imaging is not justified, even in ACS patients.



Daily PCI Practice

- Intravascular imaging is used in 15-90% of PCI cases.
- Focus: culprit lesion – stent optimization
- Information in non-stented area (non-culprit region): not used



Clinical significance of LRP



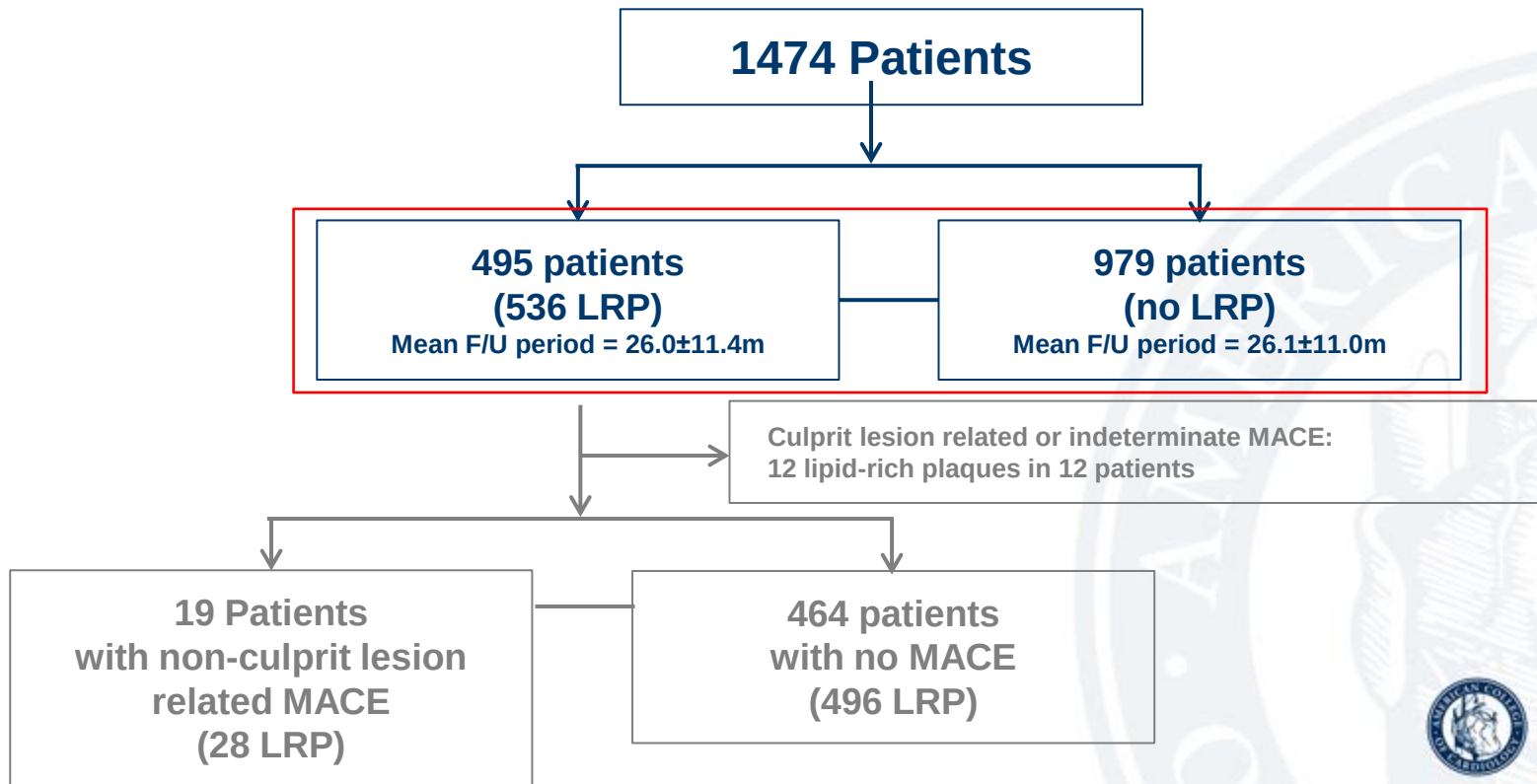
MGH OCT Registry (NCT01110538)
(20 sites across 6 countries)

Aug 2010 - May 2015
2084 patients with OCT imaging
finished at least 1-year F/U

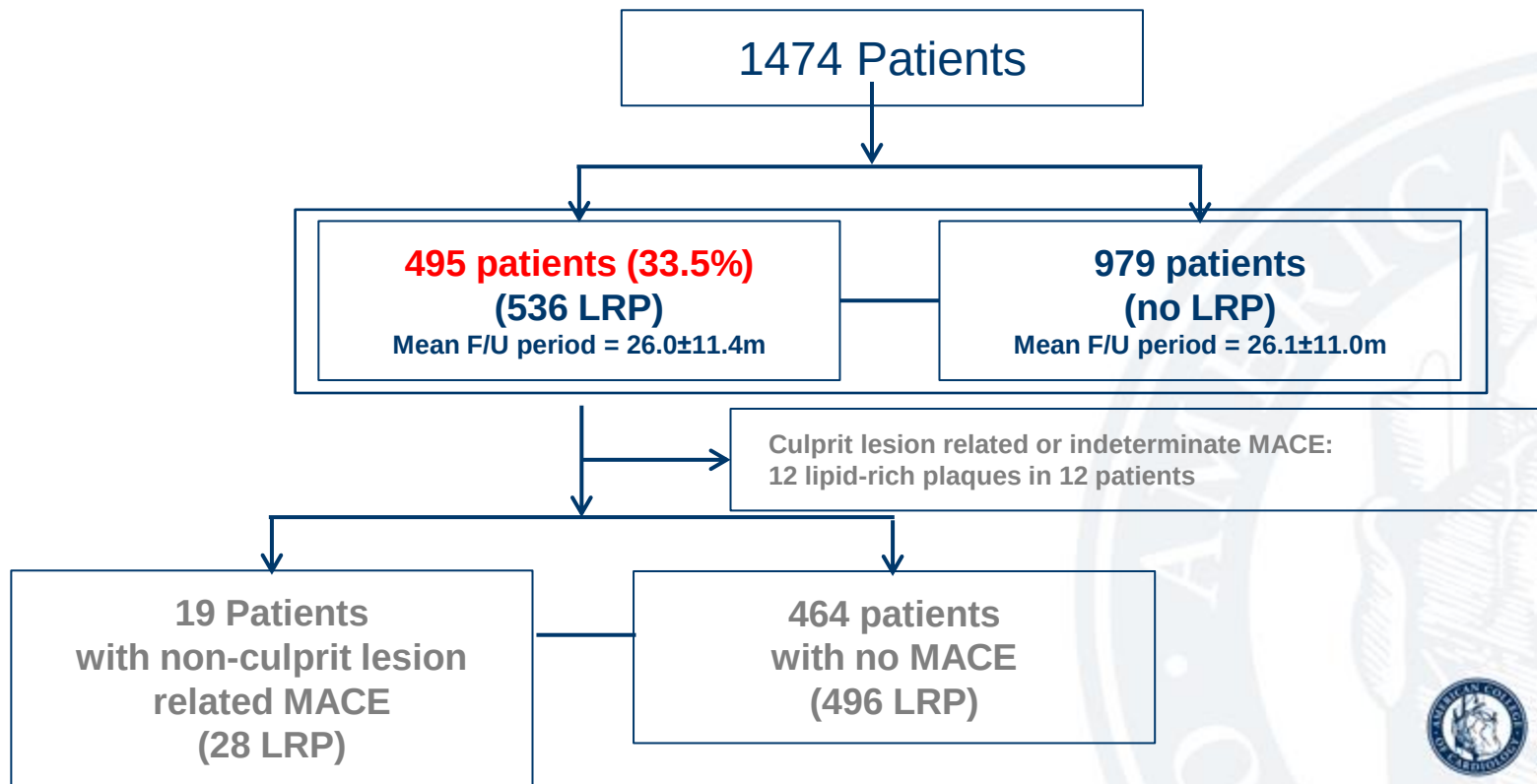
588 patients incomplete imaging of the non-culprit regions.
22 patients with poor image quality.

1474 patients with OCT imaging in the
non-culprit region of the target vessel

Patient-based Analysis

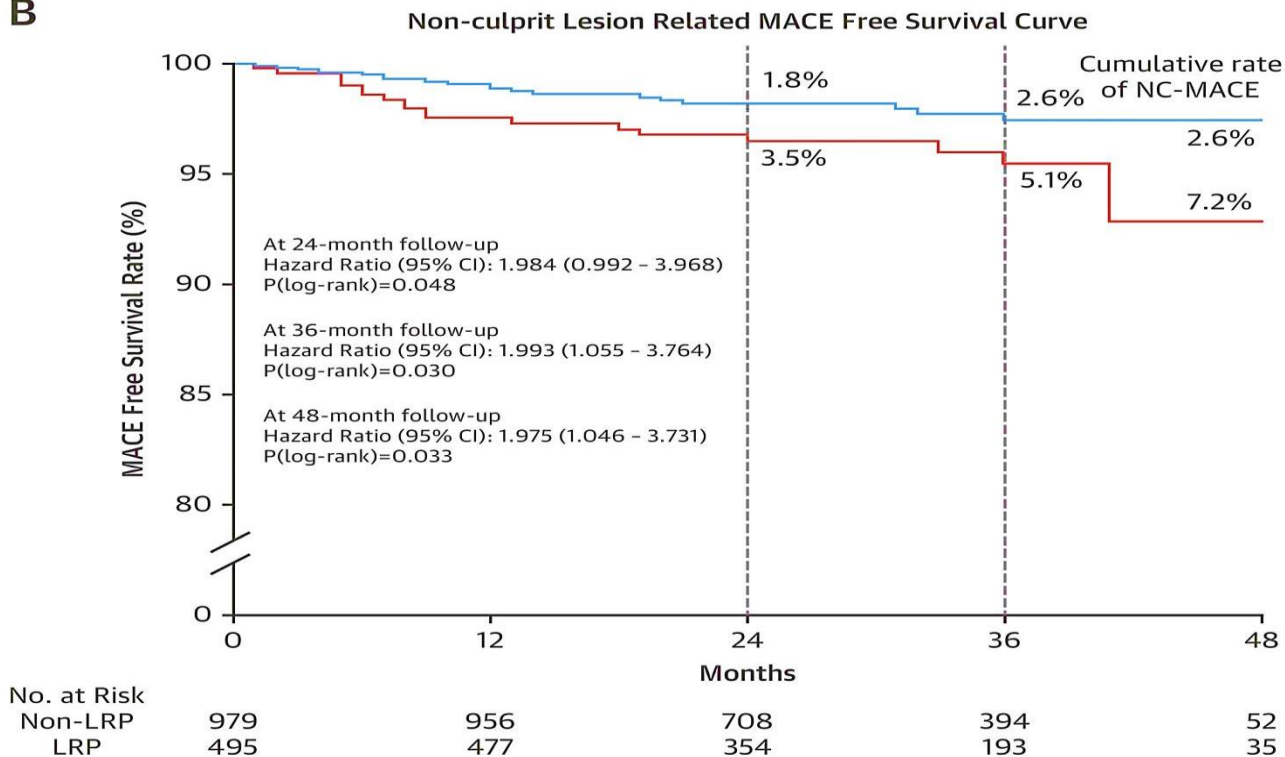


Patient-based Analysis



NC-MACE Free Survival Curve

B



No LRP group

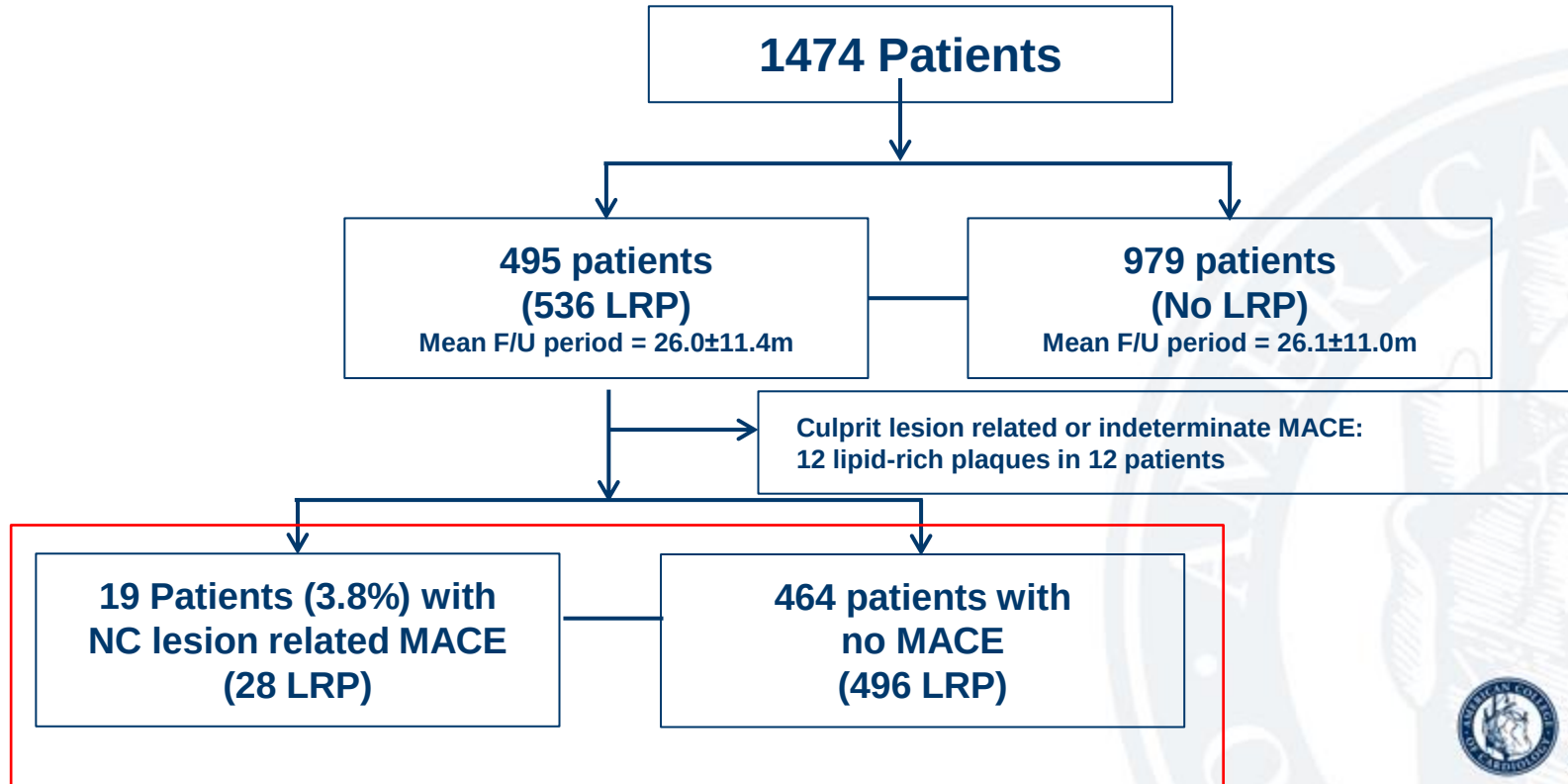
LRP group



KM Estimates for Cumulative Number (Rate) of individual MACE in 1474 patients

	All events	Culprit lesion related	Non-culprit lesion related	Undetermined
Cardiac Death, n(%)	5 (0.4)	1 (0.1)	0	4 (0.3)
Acute myocardial infarction, n(%)	21 (1.8)	11 (1.0)	9 (0.7)	1 (0.1)
STEMI, n(%)	7 (0.6)	4 (0.4)	2 (0.2)	1 (0.1)
NSTEMI, n(%)	14 (1.2)	7 (0.6)	7 (0.6)	0
Ischemia-driven revascularization, n(%)	66 (6.5)	28 (2.4)	38 (4.3)	0
Composite cardiac events, n(%)	74 (7.1)	31 (2.6)	38 (4.3)	5 (0.3)

Plaque-based Analysis

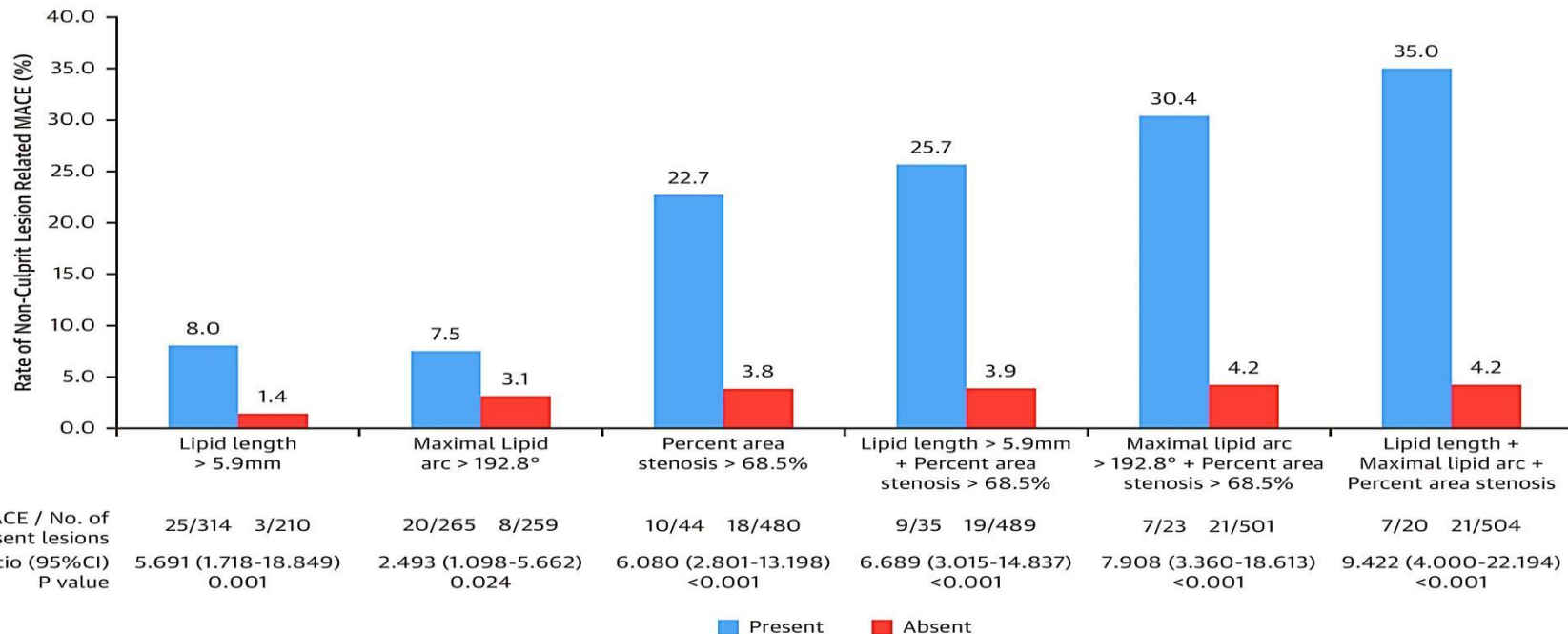


Lesion-Level Analysis

	NC-MACE (n=28)	No MACE (n=496)	P Value
Quantitative			
Fibrous cap thickness (μm)	100±64	101±52	0.977
Lipid length (mm)	9.9±3.6	7.9±4.6	<0.001
Mean lipid arc (°)	176.7±61.2	166.9±55.7	0.461
Maximal lipid arc (°)	240.9±78.4	205.1±69.3	0.023
Lipid index*	1723±880	1411±1139	0.081
Percent area stenosis (%)	56.7±15.1	47.4±15.4	0.007
Reference lumen area (mm ²)	8.85±4.58	9.75±3.92	0.333

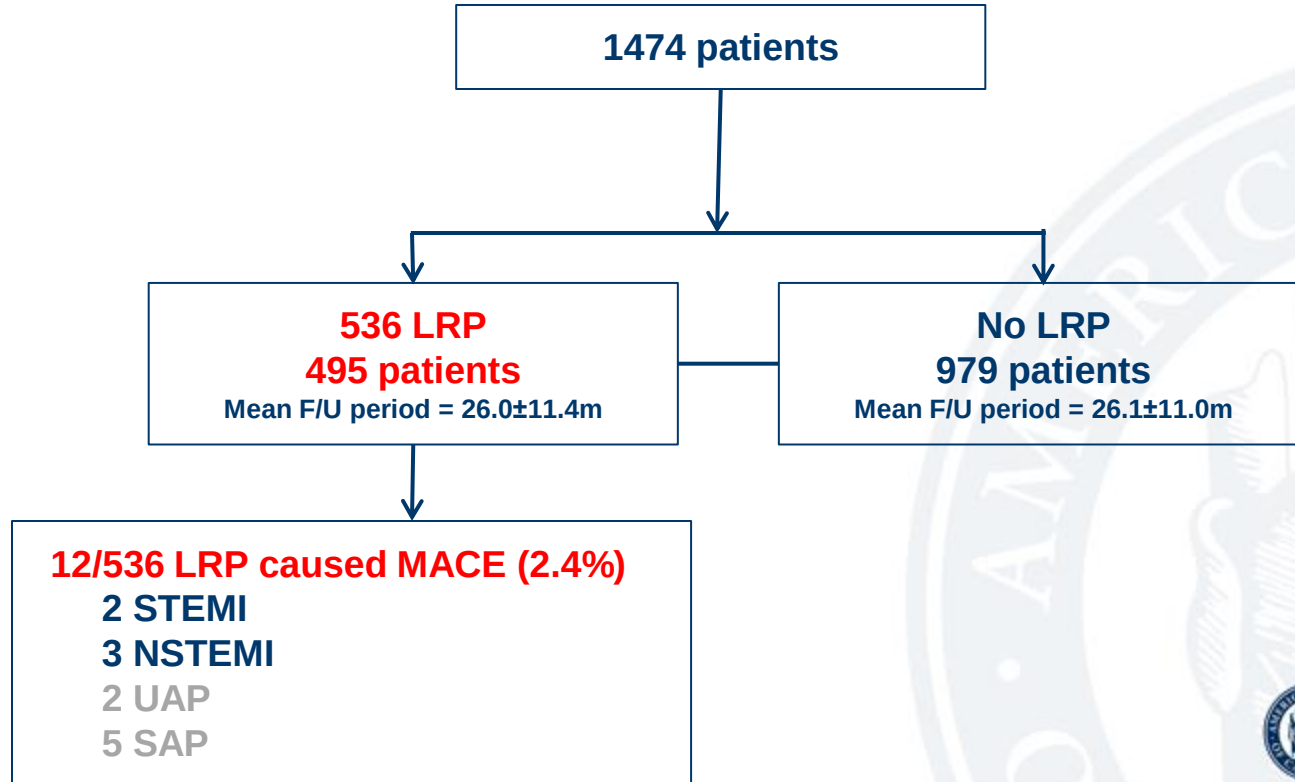
*Lipid index = lipid length x mean lipid arc

Rate of NC-MACE



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Plaque-based Analysis

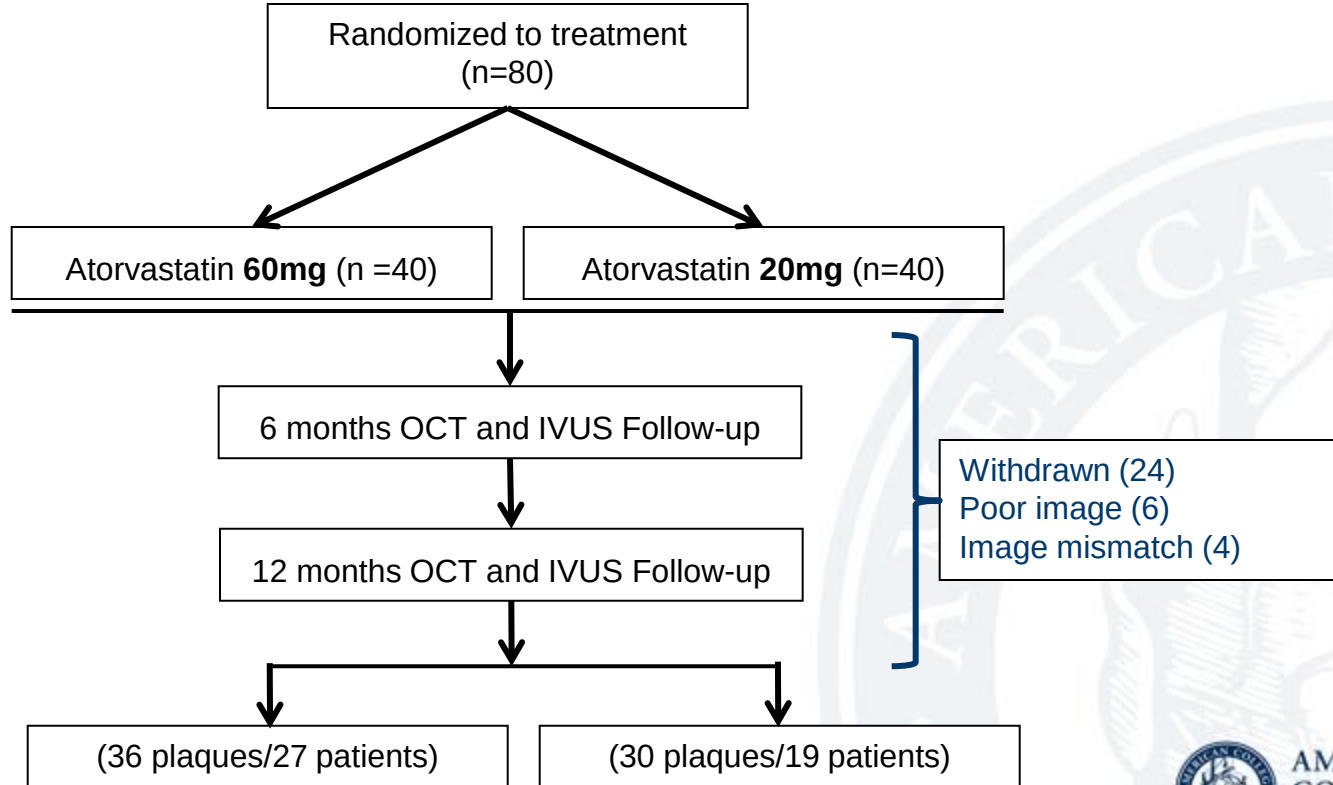


Summary

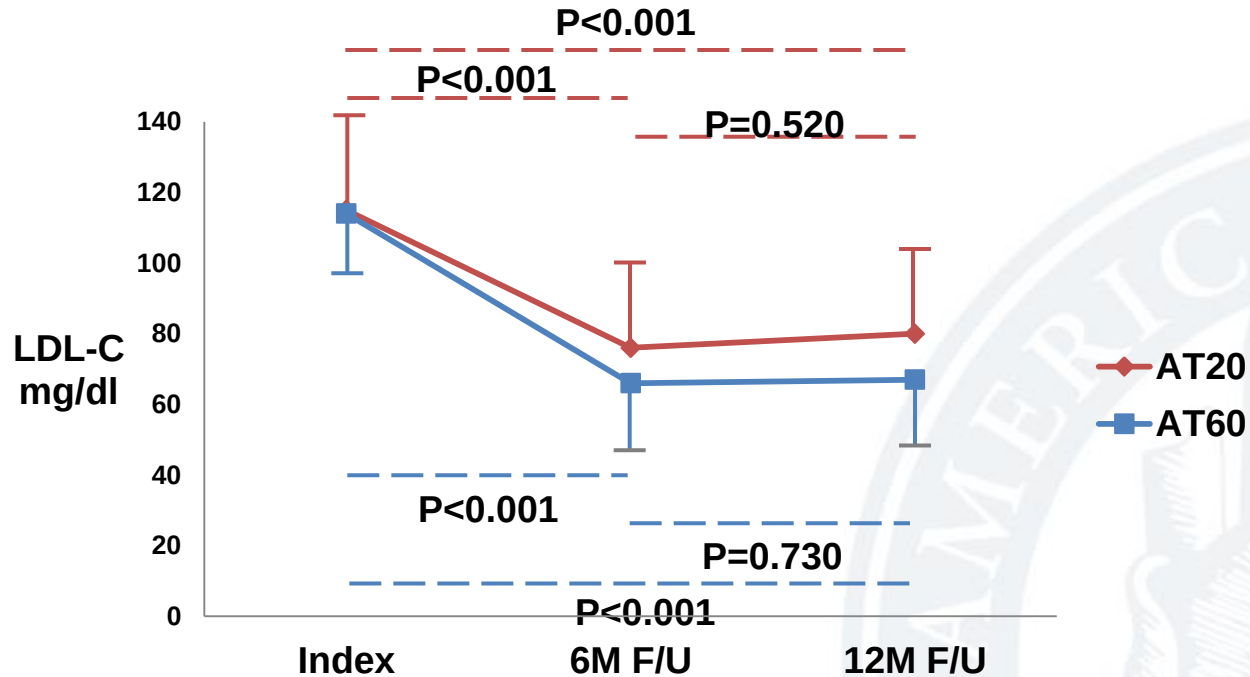
- LRP was found in non-culprit (NC) regions of target vessel in 1/3 of patients.
- Presence of LRP in the NC regions of the target vessel predicts increased risk for future NC-MACE.
- However, MACE was primarily driven by revascularization and not by SCD or AMI.
- Only 0.9% of LRP in the culprit vessel caused AMI (STEMI + NSTEMI) during 4-year F/U.



Study Design



LDL-C Levels

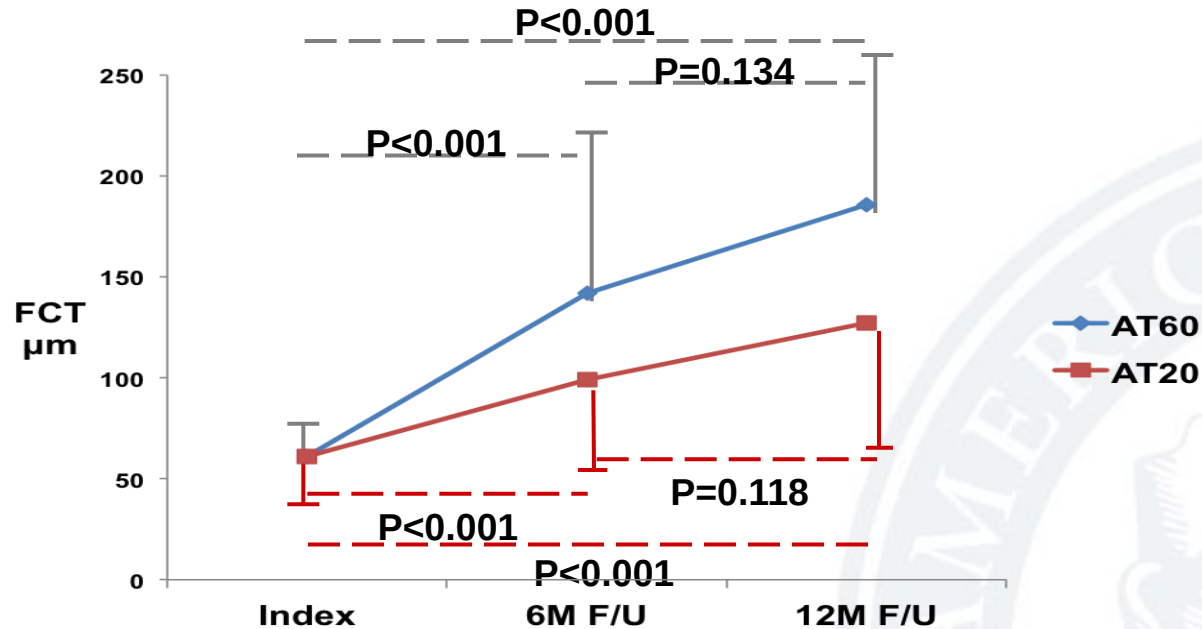


	Index	6M F/U	12M F/U
AT 20 mg (n = 19)	115±28	76±28	80±32
AT 60 mg (n = 27)	114±23	66±22	67±21



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Fibrous Cap Thickness (FCT)



AT 60 mg (n = 36)	61±21	142±91	186±85
AT 20 mg (n = 30)	61±18	99±49	127±68
P AT60 vs. AT20	0.963	0.022	0.004



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Summary (1/2)

- Prevalence of lipid-rich plaque is relatively high (1/3).
- LRP rarely causes SCD/AMI (~ 1%).
- Thin fibrous cap can be rapidly stabilized.



Summary (2/2)

- Pursuit to local detection of vulnerable plaques may not be cost effective, and may increase unnecessary risk.
- Intravascular imaging of vulnerable plaques is not ready for clinical application.



IV OCT in Clinical CAD

Feasibility

X

Predictability

X

Preventability

X X

Futurability

X X



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Collaborators

Registry

20 sites

MIT

James Fujimoto, PhD

BWH

Peter Libby, MD

Peter Stone, MD

Tschiura kyodo, Japan

Taishi Yonetsu, MD

Nara Medical Univ. Japan

Tsunenari Soeda, MD, PhD

Hirosaki Univ. Japan

Takumi Higuma, MD, PhD

Leuven Univ. Belgium

Tom Adriaenssens, MD, PhD

Univ. of Melbourne, Australia

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Luigi Biasucci, MD, PhD



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