

Non-Culprit Lesion Plaque Morphology in Patients With ST-Segment Elevation Myocardial Infarction: Results from the COMPLETE Trial Optical Coherence Tomography (OCT) Substudy

Natalia Pinilla-Echeverri MD, MSc

Shamir R. Mehta; Jia Wang; Shahar Lavi; Erick Schampaert; Warren J. Cantor; Kevin R. Bainey;
Robert C. Welsh; Saleem Kassam; Roxana Mehran; Robert F. Storey; Helen Nguyen;
Brandi Meeks; David A. Wood; John A. Cairns and Tej Sheth

Population Health Research Institute, McMaster University and Hamilton Health Sciences

Disclosures

The COMPLETE OCT Substudy was supported by Abbott Vascular,
Population Health Research Institute, Hamilton Health Sciences and
the Canadian Institutes of Health Research

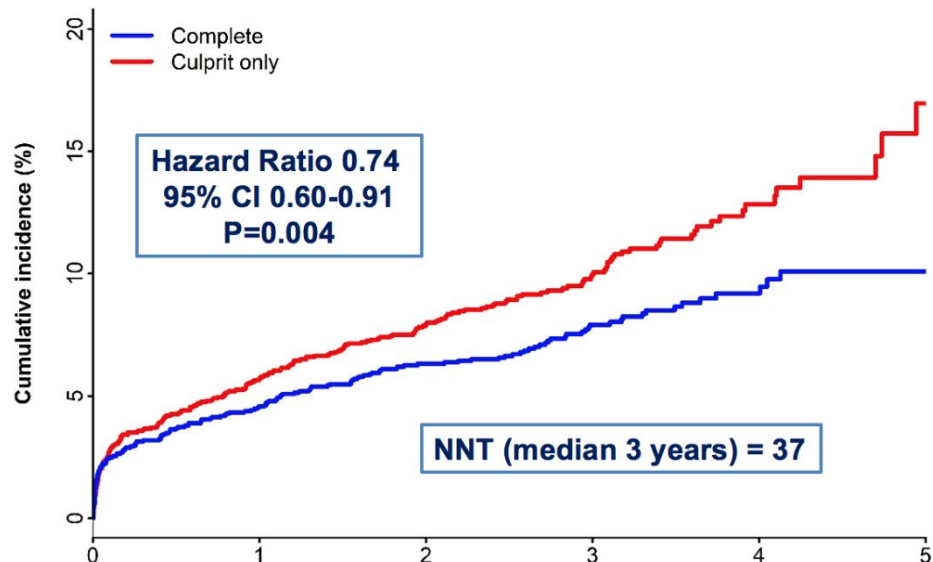
Coordinated by the Population Health Research Institute
Hamilton, Canada



COMPLETE TRIAL
OCT Substudy

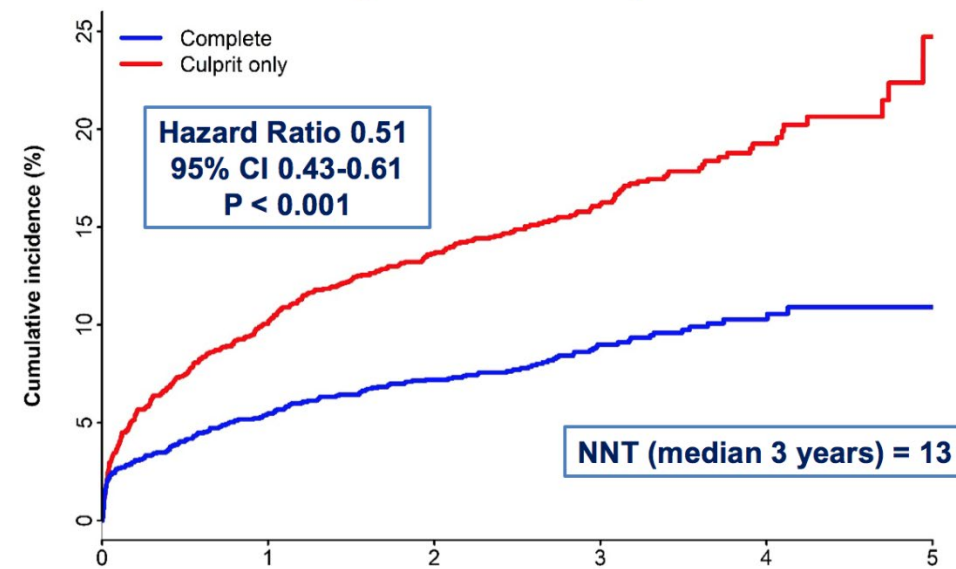
COMPLETE Trial – Primary outcomes

First Co-Primary Outcome: CV Death or New MI



No. at Risk	Years of Follow-up					
	0	1	2	3	4	5
Complete	2016	1904	1677	938	337	70
Culprit only	2025	1897	1666	933	310	59

2nd Co-Primary Outcome: CV Death, New MI, or IDR



No. at Risk	Years of Follow-up					
	0	1	2	3	4	5
Complete	2016	1886	1659	925	329	66
Culprit only	2025	1808	1559	865	294	57

The COMPLETE trial demonstrated that routine angiography-guided staged PCI of non-culprit lesions reduced the composite of cardiovascular death or new myocardial infarction by 26% ($p=0.004$).



Population Health
Research Institute
HEALTH THROUGH KNOWLEDGE

Mehta. N Engl J Med 2019; 381, 1411-1421

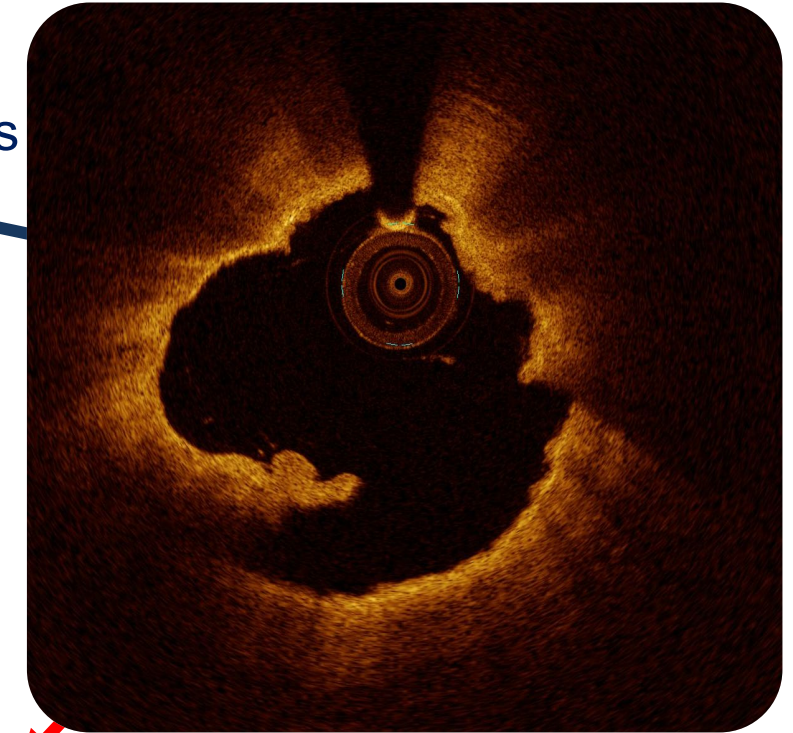


Background

- Whether the benefit of routine non-culprit lesions PCI might be associated with underlying vulnerable plaque morphology is unclear.
- Thin-cap fibro atheroma (TCFA) is a well recognized feature of vulnerable plaque.
- Optical Coherence Tomography (OCT) is a high definition intracoronary imaging modality that can identify vulnerable plaque.

TCFA: Thin Cap Fibro Atheroma

FCT: Fibrous
Cap Thickness
< 65 μm



Overlying a
lipidic plaque
Lipid arc > 90°

Plaque rupture

Hypothesis

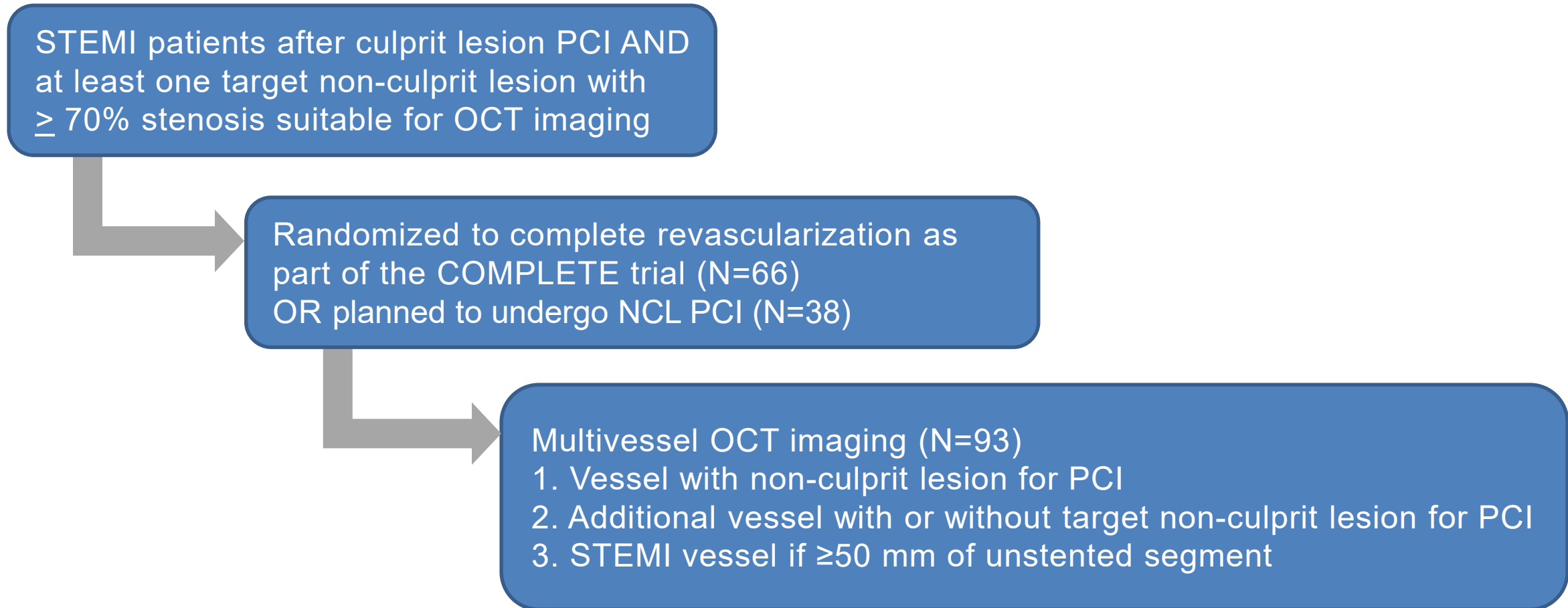
- TCFA will be more prevalent in obstructive compared with non-obstructive non-culprit lesions.

Primary Objective

In patients presenting with STEMI and multi-vessel coronary artery disease undergoing staged non-culprit lesion PCI after successful primary PCI, the objective is:

To determine the prevalence of vulnerable plaque (i.e., biologically active TCFA) in obstructive compared with non-obstructive non-culprit lesions.

Methods

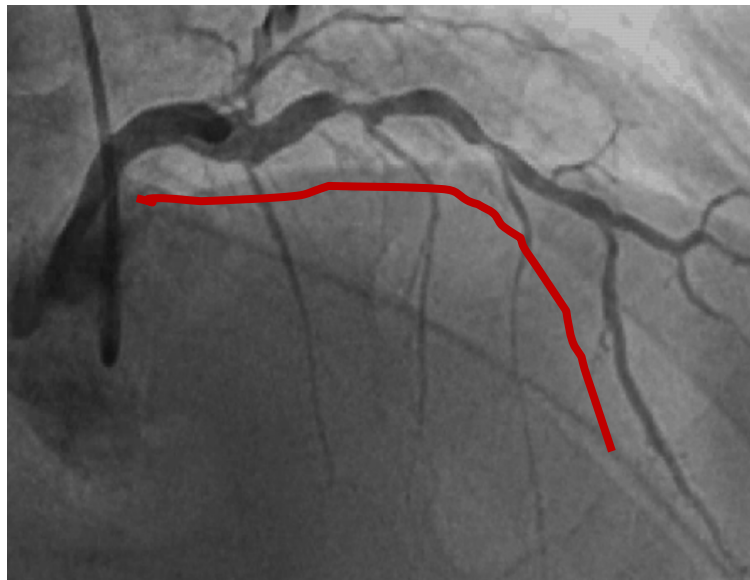




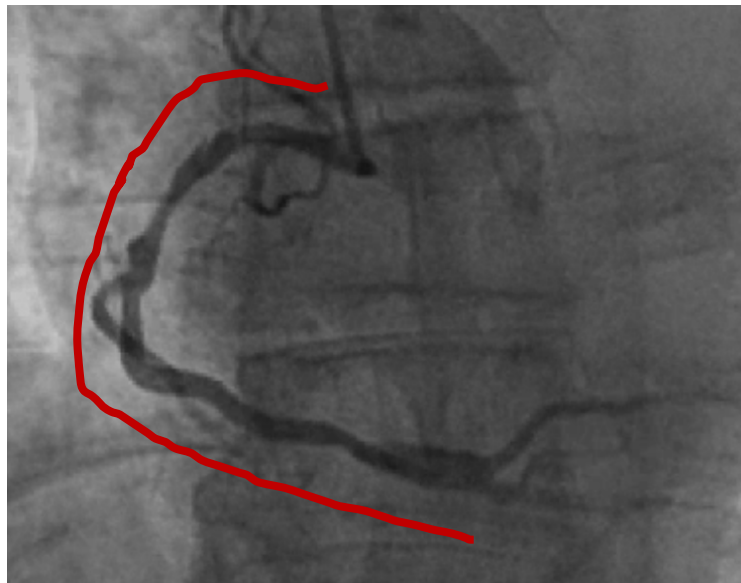
COMPLETE TRIAL
OCT Substudy

OCT COMPLETE: Imaging Protocol

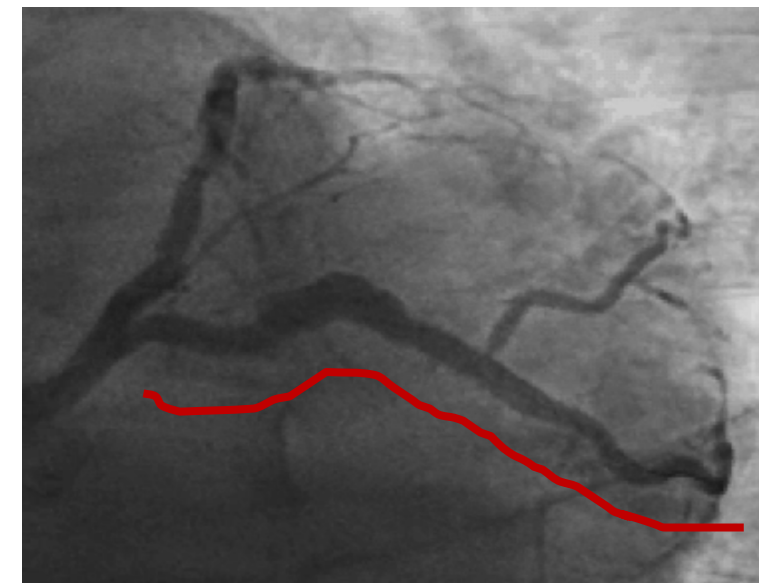
 OCT imaged segment (staged non-culprit PCI procedure)



Target 1 (LAD)
Obstructive NCL



Target 2 (RCA)
Additional vessel
Obstructive or Non-obstructive lesions



Target 3 (LCX)
STEMI vessel
If ≥ 50 mm unstented segment

- Number of pullbacks / patient (mean): 2.82
- Imaged length / patient (mean): 152.5 mm

Case example: Inferior STEMI
Culprit lesion LCX, Non-culprit lesion LAD



Population Health
Research Institute
HEALTH THROUGH KNOWLEDGE



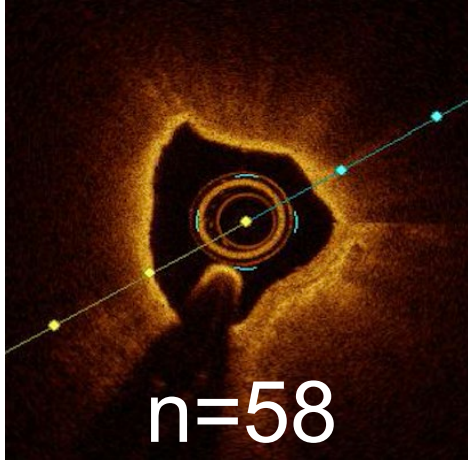
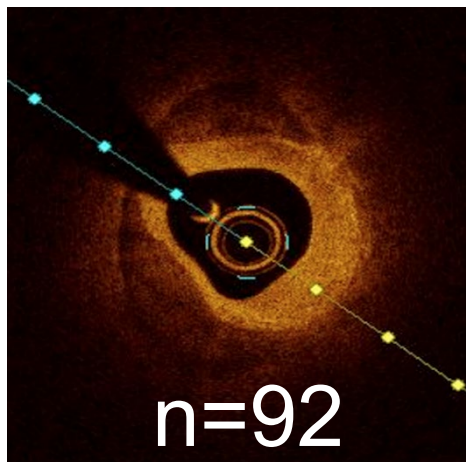
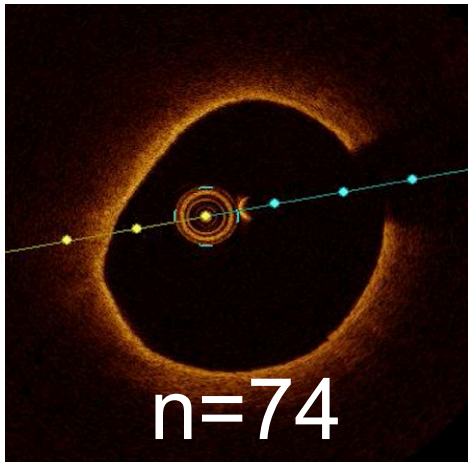
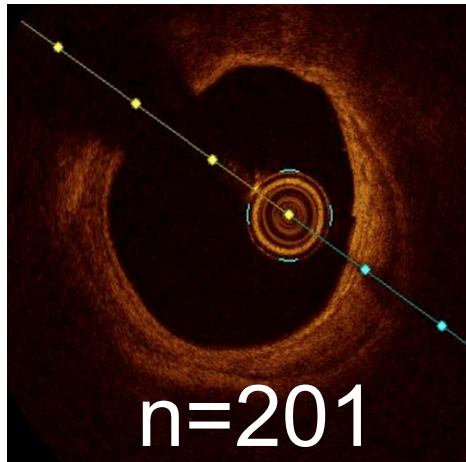
Baseline and Procedure Characteristics

	OCT Complete N=93
Age (yrs)	61.2
Gender (% male)	82.8
Diabetes (%)	12.9
Chronic renal insuff. (%)	1.1
Prior MI (%)	8.6
Current smoker (%)	38.5
Hypertension (%)	41.9
Dyslipidemia (%)	43
Prior PCI (%)	7.5
Prior stroke (%)	1.1
Hemoglobin A1C	6.1
LDL (mmol/L)	2.9
Creatinine (µmol/L)	82

	OCT Complete N=93
Residual diseased vessels	
1	64%
≥2	36%
NCL location	
Left main	0%
LAD	41%
Proximal LAD	10.4%
Mid LAD	24.6%
Circumflex	32.1%
RCA	26.9%
NCL stenosis (visual)	
70-79%	40.7%
80-89%	31.7%
90-99%	26.8%
100%	0.8%

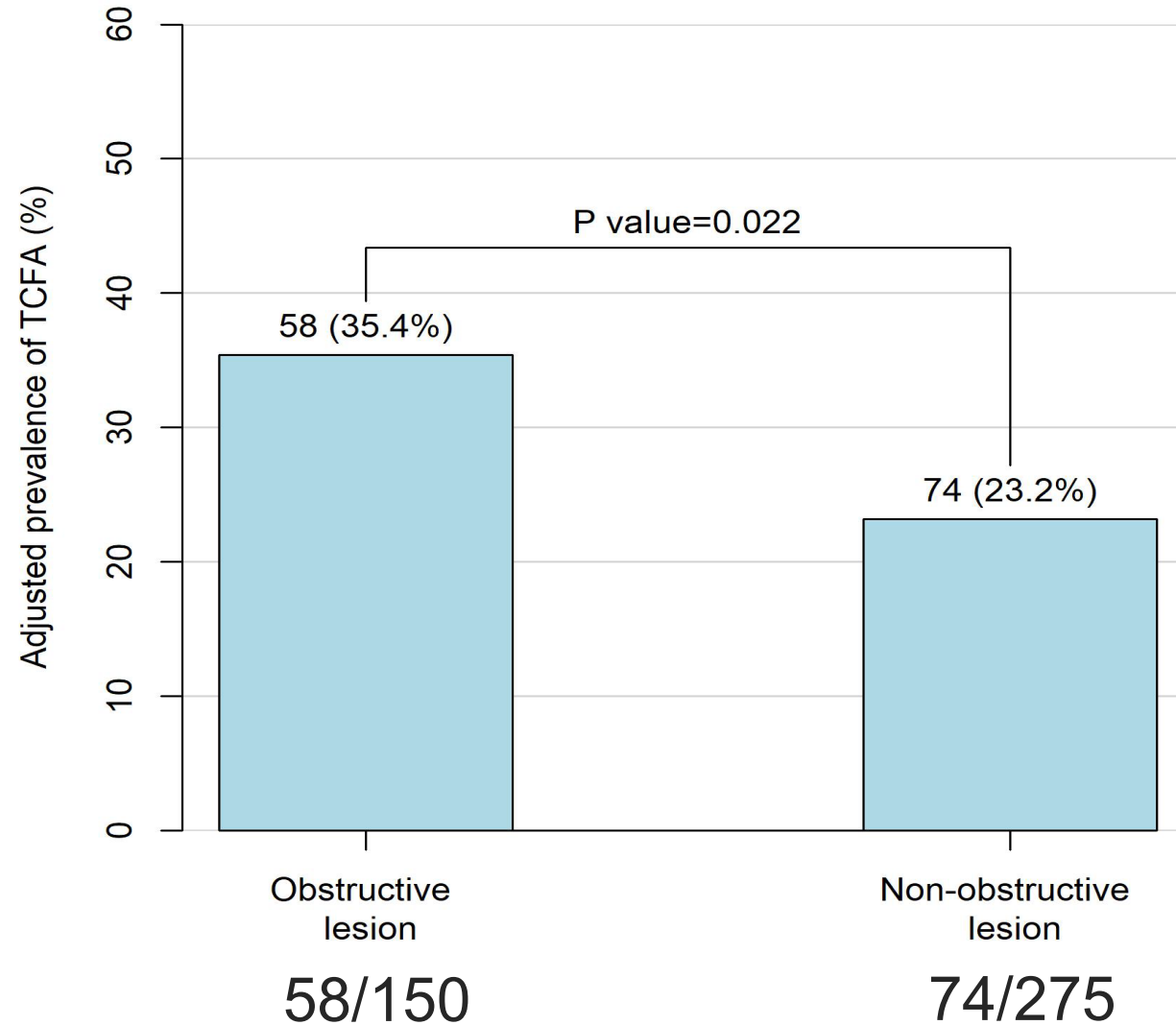
No significant differences compared with the overall COMPLETE trial characteristics

Classification of non-culprit lesions

		TCFA (FCT < 65 μ m overlying a lipidic plaque)	
		Yes	No
Obstructive $\geq 70\%$ DS	Yes	 <p>n=58</p>	 <p>n=92</p>
	No	 <p>n=74</p>	 <p>n=201</p>
		N=425	

TCFA: Thin Cap Fibro Atheroma
FCT: Fibrous Cap Thickness

Primary Outcome: Prevalence of TCFA (per lesion)



Obstructive non-culprit lesions are most likely to be vulnerable

TCFA: Thin Cap Fibro Atheroma



COMPLETE TRIAL
OCT Substudy

Results: Features of TCFA vs Non-TCFA in Obstructive lesions ($\geq 70\%$ diameter stenosis)

	TCFA (N=58)	Non-TCFA (N=92)	P value
Lesion Length (mm)	23.1	20.8	0.16
Number of LIPID quadrants	55.2	19.2	<0.001
% of LIPID quadrants	78.4	36.5	<0.001
Number of Fibrous quadrants	9.4	21.2	<0.001
% of Fibrous quadrants	16.9	43.7	<0.001
Number of Calcified quadrants	2.5	9.8	<0.001
% of Calcified quadrants	4.1	20.1	<0.001
Maximum Lipid Arc	342.2	212.5	<0.001
Mean Lipid Arc	203.8	84.5	<0.001
Mean FCT (μm)	54.5	152.2	<0.001
Minimum Lumen Area	1.9	1.7	0.52
Macrophages	55	48	<0.001
Microvessels	19	28	0.77
Cholesterol Crystals	48	42	<0.001

**Obstructive TCFA
lesions had
significantly more lipid
and more features of
plaque vulnerability
compared with
non-obstructive TCFA
lesions**

TCFA: Thin Cap Fibro Atheroma



Population Health
Research Institute
HEALTH THROUGH KNOWLEDGE





COMPLETE TRIAL
OCT Substudy

Results: TCFA (FCT < 65 µm overlying a lipidic plaque)

	Obstructive (N=58)	Non-obstructive (N=74)	P value
Lesion Length (mm)	23.1	16.7	<0.001
Number of LIPID quadrants	55.2	36.4	0.05
% of LIPID quadrants	78.4	76.8	0.73
Number of FIBROUS quadrants	9.4	7.1	0.10
% of FIBROUS quadrants	16.9	16.2	0.88
Number of CALCIFIED quadrants	2.5	1.7	0.26
% of CALCIFIED quadrants	4.1	7.0	0.39
Maximum Lipid Arc	342.2	304.0	0.06
Mean Lipid Arc	203.8	191.8	0.34
Mean FCT (µm)	54.5	54.5	0.98
Minimum Lumen Area	1.9	4.8	<0.001
Macrophages	55	65	0.28
Microvessels	19	23	0.86
Cholesterol Crystals	48	29	<0.001

Obstructive and non-obstructive TCFA lesions have similar plaque composition

Obstructive TCFA lesions were longer and had a smaller MLA

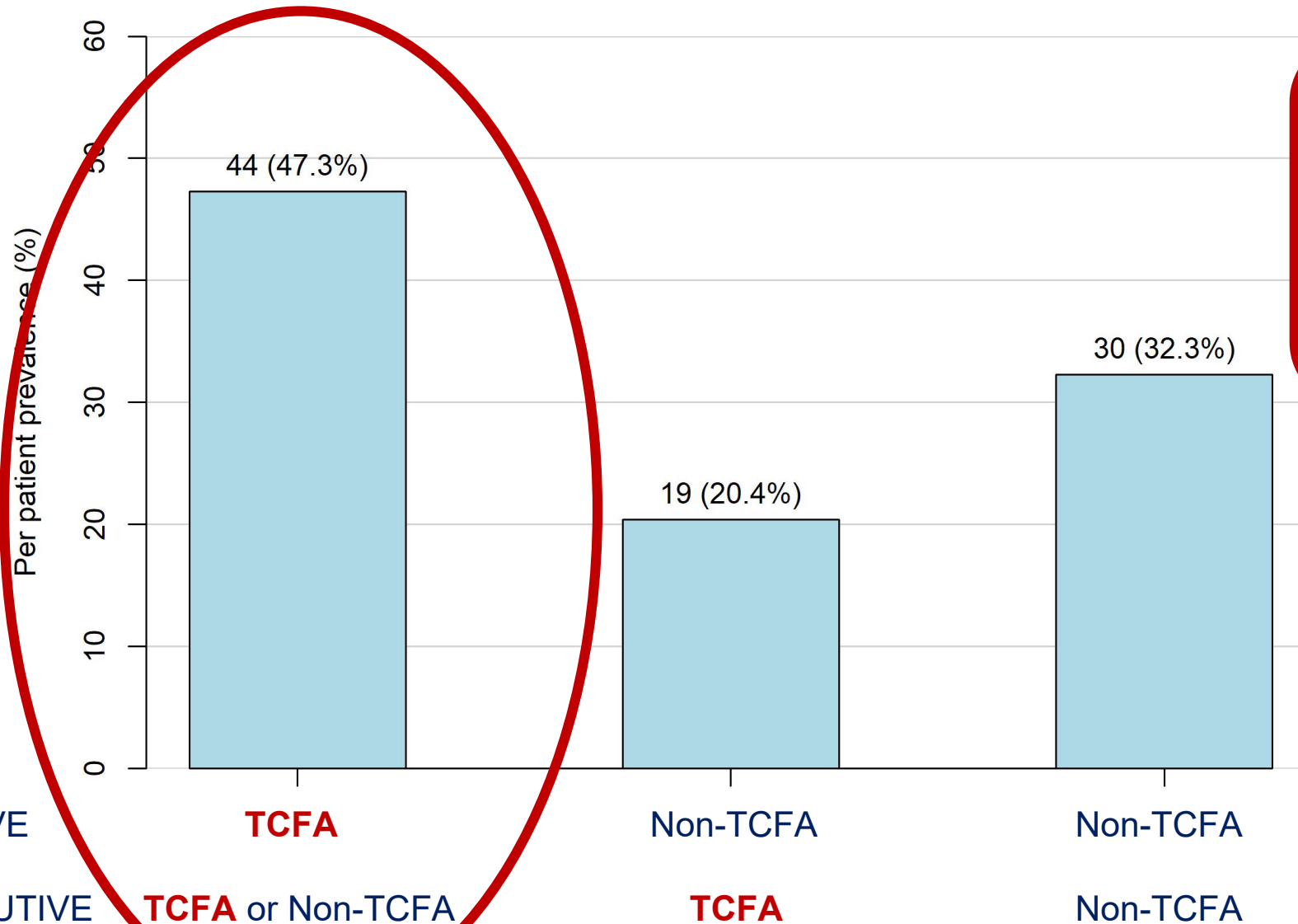
TCFA: Thin Cap Fibro Atheroma
FCT: Fibrous Cap Thickness
MLA: Minimum Lumen Area



Population Health
Research Institute
HEALTH THROUGH KNOWLEDGE



Results: Prevalence of TCFA (per patient)



**47.3% of patients had
an obstructive non-
culprit lesion containing
vulnerable plaque**

Limitations

- The COMPLETE OCT substudy was observational and designed to better understand NCL plaque morphology. It was not powered to link clinical events to plaque morphology.
- The requirement for angiographically suitable arteries for OCT imaging may have excluded certain plaque types.
- Pre-dilatation was required in some severely-stenosed obstructive lesions before imaging (18.6%), the MLA may have been overestimated in these cases.

Conclusions

In patients with STEMI and multi-vessel coronary artery disease:

- Half of patients had a non-culprit lesion with vulnerable plaque morphology by OCT.
- Obstructive lesions (>70% visual diameter stenosis) more commonly harbor vulnerable plaque morphology than non-obstructive lesions.
- This may explain the benefit of routine PCI of obstructive non-culprit lesions in patients with STEMI and multivessel disease.